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Observations made when following the Grand Trunk Road across the hills of Upper Bengal, Parus Nath, &c. in the Soane valley; and on the Kymaon branch of the Vindhya hills.—By J. D. Hooker, *M. D. R. N. Hon. Member of the Asiatic Society. (Communicated by the Hon'ble Mr. Justice* Colvile, *President of the Asiatic Society.)*

The following observations were made with the view of instituting a comparison between the vegetation of the various areas, differing in soil, elevation and general custom, which I traversed (chiefly in company with Mr. Williams* of the Geological Survey,) and the climate which accompanied these changes, and to whose operations the distribution of species is to be traced.

The Instruments used were all of the best construction, chiefly by Newman, and were uninjured up to the last observation recorded. Those made with the portable Barometer, may be relied on as very accurate, the instrument having been adjusted for me with extreme care.

The observations for Temperature were often made where constant shade was not to be obtained. Every precaution was however taken to avoid radiated heat.

* I here beg to return my most sincere thanks to Mr. Williams, not only for the opportunity he gave me of observing over a very interesting country; but for the many facilities he afforded and the uniform kind assistance I received, both from himself, Mr. Haddon, and the other gentlemen attached to his camp in which I was a guest. Few travellers have commenced their investigations under such favorable auspices; and to these much of what value the accompanying observations may possess is due.

For the wet-bulb observations, distilled water was invariably employed; and the minimum temperature taken, which is not indicated if the bulb be loaded with water, as is too often the case.

The observations for nocturnal radiation are not so accurate as if a parabolic reflector were used; they are however sufficiently demonstrative of the state of the atmosphere.

Those taken by exposing a naked thermometer on a non-radiating substance, removed from the surface of the earth, as the top of a broad brimmed Shola hat (the bulb quite free) may I think, be depended upon.

Those again indicative of the radiation from grass, whether dewed or dry, are not strictly comparable; not only does the power of radiation vary with the species, but much more with the luxuriance and length of the blades, with the situation, whether on a plane surface or raised, and with the soil upon which it grows. Of the great effect of the surrounding and subjacent soil I had frequent instances; similar tufts of the same species of grass, radiating more powerfully on the dry sandy bed of the Soane, than on the alluvium on its banks; the exposure being equal in both instances.

Experiments for the surface Temperature of the soil itself, are least satisfactory of any:—adjoining localities being no less affected by the nature, than by the state of disintegration of the surface, and amount of vegetation in proximity to the Instrument.

Such observations however are not useless: the mean of a number taken synchronously with those for the Temperature of grass and for free radiation, affording valuable results, especially if compared with the power of absorption by the same soil of the sun's heat during the day.

The power of the sun's rays is so considerable, and protracted through so long a period of the day, that I have not found the temperature of running water, even in large deep streams, so constant as was to be expected.

On a few occasions the temperature of the soil at considerable depths was obtained by sinking holes. My daily progression and the exceeding hardness of the baked alluvial soil, prevented this being fully accomplished, except on a few occasions, and as connected with the Register the observations will be detailed.

A thermometer with the bulb blackened affords the only means the traveller can generally compass, if measuring the power of the sun's rays. It will be seen that by this I have recorded a greater amount of solar heat than was supposed usual in India.

A good Photometer being still a desideratum, I had recourse to the old wedge of colored glass:—that used was so constructed as to be equivalent to a wedge of a uniform neutral tint, the distance between whose extremes, or between perfect transparency and total opacity was equal to 12 inches. A moveable arm carrying a brass plate with a slit and a vernier, enables the observer to read off at the vanishing point of the sun's limb, to $\frac{1}{500}$th of an inch. I generally took the mean of four or five observations, but place little dependence upon the results. The causes of error are too obvious for notice here. As far as the effects of the sun's light on vegetation are concerned, I am inclined to think that it is of more importance to register the number of hours or rather of parts of each hour, that the sun shines, and its clearness, during the time. To secure valuable results this should be done repeatedly, and the strength of the rays by the black bulb thermometer registered at each hour.

Finally, with regard to the hours at which the observations were taken, the three principal ones, 9 A. M., 3 P. M. and 9 P. M. were those adopted by the antarctic expedition. A morning observation was added, because the 3 A. M. one is seldom available for the traveller especially if, besides the toils of the march he has other pursuits. The most useful observations at that hour are perhaps those for the temperature of the grass, soil, &c., which vary little for many consecutive hours in the night, and are losing by radiation till the sun's power is felt.

I much regret not being at present able to enter into these computations, which would render the following observations more useful. I have preferred recording them thus early to detaining them for an indefinite period. Their publication will enable many to point out to me better modes of observation; and direct a few how to conduct such enquiries. I would also hope there are some who are, like myself, seeking for comparative observations, and to whom these will be welcome, as are all similar ones, made in other parts of India, to me.

The more important results which these will give, with more or less accuracy are:—

The mean height of the granite table-land from Taldanga to Dunwah pass, and of Parus Nath, its culminant point, above the plains of Behar (below the Dunwah pass) and the sea.

The mean height of the plains of Behar from the Dunwah pass to the Soane, and absolute height of pass.

The fall of the Soane between Kemeh (above Bidjegurh) and Dearee.

The altitude of Rotas Palace, i. e. of the Kymaon range above Akbarpore.

The altitude of the Ghaton pass in the Kymaon at Roump, and mean altitudes of the Table-land extending thence to the Bind hills at Mirzapore.

Altitude of the plains at Mirzapore. Fall of the Ganges between Mirzapore and Bhaugulpore (approximately).

Mean temperature, Dew-point, force of vapors. Weight of vapor in a cubic inch of atmosphere, and rate of evaporation as calculated from the wet-bulb thermometer on the plains of Behar, and the aforesaid table-land.

Mean amount of nocturnal radiation from the exposed thermometer, from soil and from grass, at the aforesaid place.

The barometrical elevations have been computed with great care,* but so materially does the fluctuation of the mercurial column in Behar, upper Bengal, and the other tracts of country visited, differ from those at Calcutta† that they give but approximate heights.

It has been asserted by a most excellent Meteorologist (Jas. Prinsep) and one more practically familiar with the climate of India than any other; that a few observations made at any part of N. India are so comparable with those at Calcutta, that from such the difference of elevation of the latter and any other station may be deduced with considerable accuracy. This no doubt holds true for the more level

* I cannot sufficiently express my obligation to my friends, J. and C. Muller, Esqs. for the assistance they have afforded me, in these and other computations whose results are detailed in this paper. Many of the observations were reduced by these gentlemen and the elevations determined, and all of them revised from various formulæ, some of them very complicated. What errors therefore are to be attached to the results. may be safely laid to the observer's charge, not to the Instrument, and still less to the computations.

† In Calcutta, in Feb. and March the sunrise observation is generally higher than the 9 P. M, of the previous night—on the hills and plains traversed the opposite was almost always true.

country; but amongst the hills, the changes in the state of the atmosphere are so sudden and their effects so local, that the Barometer there often continues rising during 12 hours or more when the mercurial column is stationary or even falling at Calcutta, and vice versa. There are even instances on record of moderate elevations determined from monthly means, varying upwards of one hundred feet; that of Gurgaon is from the mean of one month's observations, 868 feet; by another month's 817. Nasirabad* (by Lt. Col. T. Oliver) from one month's, 1430 feet, from another 1539 feet: the mean of two following years' observations again shew a perfect accordance. In cases where there have been continued steady weather and coincidence in the fluctuations of the column, much reliance may be placed on the height so computed from a comparison of the indications of good Instruments, provided the proper corrections† be employed. A little practice will give the observer some idea of what indications are most trustworthy. When the elevation is to be calculated from the means of several maximum or minimum observations, it is necessary to take into account the daily range at the two stations; which varies not only at different positions, bu with each month; for instance in February of one year at Calcutta the mean daily tide is 0.147.; and at Kotgurh as low as 0.028.

A considerable amount of difference in elevation is also due to the formula employed; that which I have adopted is the usual one modified by Daniel, who corrects the specific gravity of the atmosphere by the Dew-point.‡ In India the humidity of the air varies so greatly in different stations, that I think this correction should not be overlooked. It is to be remarked however, that (as Mr. Muller first pointed out to me,) in the last edition of Daniell's work, there is a discrepancy in my results as worked by the rule or by the example: the method adopted as shewn by the example, seemed to us the most correct, and except when otherwise stated this is always employed.

A very excellent formula is that used at the Surveyor General's office, for a copy of which I am indebted to Captain Thuillier, an officer to

* Jour. As. Soc. 1835 (January, No. 37. p. 49.

† In those Barometers of Troughton and Simms, used in India, I do not find a measure of the diameter of the tube to accompany the Instrument, and the correction for capillarity is hence too frequently disregarded. The diameter of the bore is generally 0.25 inch, and the consequent correction 0.040 always to be added.

‡ Daniell's Meteorological Essays, Ed. 2. (1845.) v. 2, p. 46.

whom I am exceedingly obliged for the prompt and kind manner in which he has afforded me effectual assistance in various ways.

The Dew-point has been calculated from the Wet bulb, by Dr. Apjohn's formulæ, or, where the depression of the Barometer is considerable, by those as modified by Captain Boileau.* The saturation point, by dividing the tension at the dew point by that at the ordinary temperature. Weight of vapor, by Daniell's formula.

For the means of availing myself of Mr. Williams' kind invitation, so soon after my arrival in India, I am mainly indebted to the President of the Asiatic Society, who not only anticipated my wants by himself equipping me for a mode of travelling widely different from what I had been accustomed to, but has forwarded my views by every means in his power, and shown the warmest interest in my pursuits and kindness to myself. *Darjeeling, Aug.* 1848.

My botanical outfit was all procured for me at the Botanic Garden, by the kindness of Dr. McLelland, to whom I return many thanks for the valuable assistance and advice he afforded me, and the ready manner in which he placed every aid the noble establishment he then superintended could command, at my service.

January 30th.—Joined Mr. Williams' camp at Taldangah, on the Grand Trunk Road, a dawk station near to the western limit of the coal basin (Damoodah valley).

Leaving early the following morning, I had no opportunity of inspecting the fossil plants of this field in situ. An examination of a noble collection sent to England by Mr. Williams, (previous to my departure,) throws but little light on the age of the formation, as compared with the more northern ones. The genera to which the species belong are, some English, a few very remarkable ones Australian, and many others peculiar to the Indian coal fields. The European genera or species, are more allied in appearance to those of the Oolite formation than of the carboniferous æra, but I take this resemblance to be possibly accidental, and not to demand a reference of the Indian coal beds to the period of the English Oolite. Arguing from analogy, it is difficult to suppose that the cotemporaneous Floras of two coun-

* Journal of Asiatic Society, N. 147, (1844) p. 135.

tries as widely remote in geographical position as in physical features, should possess any plants in common: and especially so large a proportion of species, that a recognizable number of these should survive that wreck of a Regnum Vegetabile of whose existence the coal and its accompanying fossils are rather the Index than the Historians. It is certainly very remarkable that any distinct relationship should exist between the English and Indian coal fields, and that it is betrayed by a genus so peculiar as *Glossopteris*, which is further common to the fossil Flora of Australia; but this circumstance loses value from the fact of prevailing forms of Ferns being common to species from all parts of the world, and yet indicating no affinity between such plants, which are only to be recognized by their fructification, an obsolete character in almost all fossil specimens. The Oolite coal of England, again, abounds in representatives of existing tropical plants—these are absent in the Indian coal fields; which on the other hand presents us with novel forms of vegetable life, some of them common only to this and to the Australian fossil Flora, and equally distinct from any known living or fossil vegetables. In short, the Indian coal fossils are more widely dissimilar from any living plants either of the temperate or tropical Flora, than are the fossils of the oldest English carboniferous period. I do not moot the question of the age of these beds in a geological point of view, for that subject is in able hands; though having now visited the Australian, Indian and English Oolite beds, I may add that the two former present the strongest features in common, both in points of extent, and in position (geologically and otherwise), as also a wide difference in their Floras from those flourishing over them.

The Rev. Mr. Everest, in some excellent remarks on this coal field considers the position of the beds relatively to the general features of the surrounding country, as evidences of the coal having been deposited in hollows between the granite hills which rise out of the plain, like islets.*

I had no opportunity of verifying this theory, which is perhaps hardly compatible with the proofs (and these are ample) of the relative position of the coal-beds having suffered much change since their deposition.

* Gleanings of Science, 1831, p. 133.

The workmen employed at the pits use water from the hookah in preference to any other, for the manufacture of gunpowder, but I could not ascertain that there were any good grounds for this choice. The charcoal is made from an *Acacia* (*Catechu ?*); that from *Justicia Adhatoda* is more generally used in India; *Calotropis* wood in Arabia. The pith of all these plants is large, whereas in England, closer-grained and more woody trees, especially willows, are preferred.

A few miles beyond Taldangah the junction of the sandstone and gneiss rocks forming the elevated table-land of upper Bengal, is passed over. From beyond Burdwan the country slopes gradually up to Taldangah, but travelling by dawk at night, I could not estimate the amount of rise. From the latter station the ascent is still gradual, without any material interruption at the change in geological formation. Both sides of the road, and both formations are singularly barren, and the primitive rocks perhaps more so than the sandstone, from the copious effloresced salts, and frequency of masses of granite and quartz protruded through the soil. Good-sized timber is nowhere seen: the trees are stunted, chiefly *Butea frondosa, Diospyros, Terminalia,* and shrubs of *Zizyphus,* and *Acacia, Grislea tomentosa* and *Carissa Carandas.*

The altitude of Gyra is about 652 feet above the sea: it is the first station on the primitive table-land, which extends from this to Dunwah pass, and whose culminant point here is Parus Nath; Main path being another plateau, I believe on the same range of hills, but further S. W. Parus Nath, the eastern metropolis of Jain worship, as mount Abo is the western, is seen towering far above all the other eminences, and so isolated as to form from every side a noble feature in the landscape. All other hills are low ridges, running in various directions. Bamboo certainly forms one third of the jungle on these hills, and from its tints, varying from bright green to absolute whiteness, it gives some variety to the coloring. *Acanthaceæ,* in number of species, prevail beyond any other natural order, both as herbs and bushes; but the *Zizyphus* is the next plant in abundance to the Bamboo, and next the *Carissa Carandas.*

The cultivation is here, as elsewhere along these elevated plains, very wretched, for though alluvion is spread over the schists, the rocks are so dislocated as often to be thrown up at right angles, when their de-

composition produces a very barren soil full of salts. The bosses of ungrateful quartz render this sterile country more hungry still. Rice fields are scarce and scattered; I saw very little corn, grain, or castor oil; no poppy, cotton or Carthamus. A very little sugar-cane, with dhal, mustard, rape and linseed, include nearly all the crops I observed.* Palms are very scarce and the cottage seldom boasts the banana or tamarind, orange, cocoa-nut or date. The Mahowa tree however is common, and a few Mangoes are seen.

February 2nd.—Marched to Fitcorce, the country being more hilly and still ascending to this station which is 824 feet above the sea. Though the night had been clear and star-light, no dew was deposited, and therefore for the future I took the temperature of the grass, both after sun-set and before sun-rise, as also of a Thermometer with a naked ball exposed to the sky on a non-conducting material. During the whole time I spent on this table-land the temperature of the grass never sunk to that of the Dew-point, though the nights were always fine. The copious dews that I had experienced on the much drier Egyptian desert, between Cairo and Suez, were equally remarkable for their abundance, as their absence is here. The only cause for this that I can assign is an almost imperceptible haze, which may be observed during mornings, producing that peculiar softening of the tints in the landscape which the artist can well appreciate, but whose presence does not interfere with a perfect definition of outlines in distant objects.

The nights too are calm, so that the little moisture suspended in the atmosphere, may be (during these nights) condensed in a thin stratum considerably above the mean level of the soil, at a height determined by that of the surrounding hills. The cooled surfaces of the latter would further favor this arrangement of a stratum of vapor above the heated surface of the earth, with the free radiation from which it would mutually check. Such strata may even be seen, crossing the hills in ribbon-like masses, though not so clearly on the elevated region, as on the plains bounding the lower course of the Soane, where the vapor is more dense, and the hills scattered and the whole atmosphere more humid.

During the 10 days I spent amongst the hills I saw but one cloudy sun-rise, whereas below, whether at Calcutta, or on the banks of the

* The Tussar silkworm is reared in some parts of the hills, especially the northern.

Soane, the sun always rose behind a dense fog-bank. This was when close to Parus Nath, and the effect of a slight east wind, forming, first a stratus amongst the mountains to the west, which gradually rose, obscuring the whole sky with cirrho-cumulus. On all other mornings the sun-rise was clear and cloudless ; though through a visible haze.

At 9½ A. M. the black-bulb Thermometer rose in the sun to 130°. The morning observation before 10 or 11 A. M. always gives a higher result than at noon, though the sun's declination is so considerably less, and in the hottest part of the day it is lower still (3½ P. M. 109°,) an effect no doubt due to the vapors raised by the sun, and which equally interfere with the Photometer observations.* The N. W. winds invariably rise at about 9 A. M. and blow with increasing strength till sunset ; they are no doubt due to the rarefaction of the air over these heated plains, and being loaded with dust, the temperature of the atmosphere is raised by the passage of a warm body, which at the same time that it varies the temperature in the shade, depresses the black-bulb Thermometer. The increased temperature of the afternoon is therefore not due wholly to the accumulation or absorption of caloric from the direct sun's rays, but to the passage of a heated current of air derived from the much hotter regions to the westward. It would be interesting to know how far this N. W. diurnal tide extends ; and if it crosses the Sunderbunds or upper part of the Gangetic delta ; also the rate at which it gathers moisture in its progress over those damp regions. Of its excessive dryness at Benares, Prinsep's observations give ample proof, and I shall compare these with my own observations, both in the valleys of the Soane and Ganges, and on the elevated plains of Behar and Bengal and of Mirzapur.

Observations with the black-bulb Thermometer, though confessedly imperfect, are of considerable interest, and that they have attracted little notice in India is evident from a paper of Capt. Campbell,† who mentions that in Lat. 18° N. 43° is the maximum effect he ever obtained, and that Dr. Baikie has shown 24° to be the maximum on the Neelghery mountains in January. In February and March I have repeatedly observed a difference of upwards of 50°, and on one occasion of 68°. These were in Lat. 25° N. On the Kymaon hills (alt. 1104 ft.)

* See Analysis of Observations.
† Calcutta Journal of Nat. His. v. 2. p. 185.

I have registered the black-bulb Thermometer at 150°, a temperature and difference so little short of what has ever been observed in higher latitudes that we must look to other causes than distance from the Poles for the generally diminished power of the sun's rays in and near the tropics. The low results cited by Daniel* were all obtained from Pelagic stations, as are Capt. Campbell's, compared with my own; nor have I on the tropical and sub-tropical coasts of Africa and S. America, or on the ocean at a distance from land, ever obtained results at all to be compared with these. It is much to be regretted that an instrument so simple and easy of observation should be so neglected. The value of its indications are approximate only, but not the less necessary, as may be gathered from the circumstances of the few experiments I have been enabled to make tending to invalidate a theory grounded on a comparison of all the observations hitherto made in low latitudes.†

* Meteorological Essays, Ed. 2. v. 2. p. 110.

† Since writing the above I have met with a paper by the Rev. Mr. Everest "On the Meteorology of Ghazipur:" in which a record is contained of observations taken with a Thermometer laid on black wool and freely exposed to the sun in the months of September and October. (As. Journ. 1833, p. 605.) The range of the exposed Thermometer in these observations coincides very nearly with my own. The maximum being attained at 11 A. M. and the greatest difference observed is also at that hour (50°.6).

Dr. McLelland,* who has made some excellent analyses of the meteorological phenomena of India, attributes the haze of the atmosphere during the N. W. winds of this season, wholly to the suspended earthy particles. That such may be the case to a great degree is clear, for the amount of the haze is evidently proportioned to the force of the wind during the prevalence of the Diurnal breeze. But the haze is always present, even in the calmest weather, when it is only to be accounted for by the hygrometric state of the atmosphere. Extreme dryness, (which here is so marked that there is no deposition of dew,) is in all parts of the world usually accompanied by an obscure horizon.

Capt. Campbell also objects to the conclusiveness of Dr. McLelland's theory, citing those parts of Southern India which are least likely to be visited by dust storms, as possessing an equally hazy atmosphere, and further denies its being influenced by the hygrometric state of the atmosphere. (Cal. Journ. Nat. His. v. 2. p. 44). I have observed the same phenomenon in oceanic islands, when the surface rocks were powerfully heated by a tropical sun, and the air extremely dry, and I have further remarked a brilliantly clear atmosphere with a similarly low Dew point in the Antarctic Ocean, where the horizon was ice-bound: hence it is probably not so much the amount of vapor as its tension that determines the transparency of the atmosphere.

When on this subject I may add that even on the ocean the air is sometime so brilliantly clear that Venus is visible at mid-day during a strong sun-light. I have seen that planet in the north tropical Atlantic under similar circumstances to what Dr. Campbell did at Kemedy, (Cal. Journ. Nat. His. v. 2, p. 279,) but have not with me the date or corresponding observations.

* Cal. Journ. Nat. His. v. 1, p. 52.

February 2nd.—Proceeded on to Tofe-choney (or Top-chaunsee.) General features similar to those of yesterday, but the country more wooded and ascent considerable; alt. of station 900 feet. Tanks here are covered with the usual water plants of India: *Villarsia Cristata, Nymphæa, Chara* and *Potamogeton*. The increased shade favors the growth of several ferns, as *Lygodium, Pteris, Adiantum, Cheilanthes* and *Selaginella*. The situation near the foot of Parus Nath, a heavily timbered lofty mountain rising abruptly, and terminated in a rugged ridge, is very pretty. A few rock Lichens are found here. Many trees appear, with *Nauclea, Bignonia, Combretum* and *Bauhinia, Gmelina arborea* and *parvifolia*. *Butea frondosa* continues abundant. In this district the greater proportion of Stick-Lac is collected from *Butea;* in Mirzapur, a species of Sponia yields it, and the Peepul very commonly in various parts of India. The elaboration of this dye, whether by the same species of insect, or by many from plants so widely different in habit and characters, is a very curious fact.

February 3rd.—At 3 A. M. the temperature was 55°, and to the feeling very cold. This being the most convenient station from whence to ascend Parus Nath, we left early in the morning for the village of Maddaobund, on the north base of the mountain, from whence a good path leads to the summit.

Following the Grand Trunk Road for a few miles to the west, after passing the base of the mountain, a narrow path strikes off to the north winding through low valleys and over finely wooded plains, covered with noble trees of *Bassia*, like Oaks in a park, *Fici, Gmelina*, two species of *Diospyros, Buchanania latifolia, Nauclea cordifolia, Semicarpus anacardium, Bauhinias*, with clumps of large Bamboo. The undershrubs are still of *Vitex, Carissa, Grislea tomentosa, Zyzyphi*, and stunted *Butea;* the grapes wiry and harsh, *Adropogons, Anthristia, Saccharum*, &c. Some villages at the west base of the mountain occupy a better soil and are surrounded with richer cultivation; palms and mangoes and the tamarind, the first and last rare features in this part of Bengal, appeared to be common here, with fields of rice and broad acres of Flax and Rape, through the latter of which the blue *Orobanche Indica* was swarming. The short route to Maddaobund, through narrow rocky valleys, was impracticable for the elephants, and we had to make a very considerable detour, only reaching that village

(on the north base of the mountain) at 2 P. M. All the hill people we had observed were a fine-looking athletic race; they disown the tiger as a neighbour, which every palkee-bearer along the road declares to carry off the torch-bearers, torch and all. Bears they say are scarce and all other wild animals.

The site of Maddaobund, elevated 1217 feet, in a clearance of the forest, is very beautiful. Fine tamarind trees and a superb Banyan shadow its temples, and the ascent is immediately from the village up a pathway worn by the feet of many a pilgrim, from the most remote parts of India.

The village was crowded with worshippers, whose numerous vehicles of all shapes and build, reminded one of an electioneering in an English country-town. Though so well wooded the forests of its base are far from rich in species of plants.

February 4th.—At 6½ A. M. having provided chairs slung on four men's shoulders, in which I put my papers and boxes, we commenced the ascent; at first through woods of the common trees, with large clumps of Bamboos, over slaty rocks of gneiss, much inclined and sloping away from the mountain. The view from a ridge 500 feet high was superb, of the village, and its white domes half buried in the forest below, and of the latter, continued for many miles to the northward. Descending to a valley some Ferns were met with, and a more luxuriant vegetation, especially of *Urticeæ*. Wild Bananas formed a beautiful, and to me novel feature in the woods; these I took for granted were planted, but I have since heard that the plant is wild in the Rajmahal hills, N. E. of this (and of which these mountains are a continuation) and hence no doubt here also. A white-flowered Rubiaceous plant (*Hamiltonia suaveolens*) was everywhere abundant, and very handsome, with many *Acanthaceæ* and *Leguminosæ*, but few *Cryptogamiæ*. The mounds raised by the white-ant appear to me not an independent structure, but the debris of clumps of Bamboos, or of the trunks of large trees which these insects have destroyed. As they work up a tree from the ground, they coat the bark with particles of silicious soil, glued together, carrying up this artificial sheath or covered way as they ascend. A clump of Bamboo is thus speedily killed, the culms fall away, leaving the mass of stumps coated with sand, which the action of the weather soon fashions into a cone of earthy matter.

Ascending again, the path strikes up the hill, through a thick forest of *Sal (Vateria robusta)* and other trees, spanned with cables of scandent *Bauhinia* stems. At about 3000 feet above the sea, the vegetation becomes more luxuriant, and by a little stream, I collected 5 species of Ferns, some Mosses and *Hepaticæ*, all in a dry state however; *Ficus artocarpifolia ?* which sends hanging tufts of leafless twigs from the limbs, was abundantly covered with fruit. Some *Smilaceæ*, *Disporum*, *Clematis*, a terrestrial Orchideous plant, and *Arginetia*, next appeared, and still ascending *Roxburghia viridiflora*, an increased number of grasses and *Cyperaceæ* are met with; the *Hamiltonia* ceases, and is succeeded by other bushes of *Verbenaceæ* and *Compositæ*. The white-ant apparently does not enter this damper region. On ascending to 3500 feet the vegetation again changes, the trees all become gnarled, stunted, and scattered, and as the dampness also increases, more Mosses and Ferns appear. Emerged from the forest at the foot of the great ridge of rocky peaks, stretching E. and W. 3 or 4 miles. Abundance of a species of Barberry and an *Osbeckia* marked the change in the vegetation most decidedly, and were frequent over the whole summit, with coarse grasses, *Cyperaceæ*, and various bushes.

At noon reached the saddle of the crest, where was a small temple, one of 5 or 6 which occupy various prominences of the ridge.

The wind, N. W. was cold, the temp. 56°. The view beautiful, but the atmosphere too hazy. To the north ranges of low wooded hills, and the course of the Barracker and Adji rivers. To the south a flatter country, with lower ranges, and the Dunmoodah river, its all but waterless bed snowy white from the exposed granite blocks it strews along its course. East and west the several sharp ridges of the mountain itself; the western considerably the highest, and each crowned with a white temple. Immediately below, the mountain flanks appear, clothed with impenetrable forest, here and there interrupted by rocky eminences. To the north the Grand Trunk Road shoots across the plains, like a white thread, stretched as straight as an arrow, spanning here and there the beds of the mountain torrents, with the pretty bridges of my friend Lieut. Beadle.

On the south side the vegetation was more luxuriant than on the north, though from the heat of the sun the opposite might be expected. This is owing partly to the curve taken by the ridge being open to the south

and to the south winds being the damp ones. Accordingly, plants which I had left 3000 feet below in the north ascent, here ascended to near the summit, such as *Fici*, Bananas and various weeds. A small short-stemmed Palm (*Phœnix*) was tolerably abundant, (propably *P. Ouselayanæ*, Griff.) and a small tree of *Pterospermum*, on which a species of grass grew epiphytially: but too withered to determine; it formed a curious feature.

The situation of the principal temple is very fine, below the saddle in a hollow facing the south, surrounded by forest and the Banana and Banian. It is small but handsome, contains little inside to remark, but the sculptured feets of Parus Nath and some slabs of marble with Boodh idols; cross-legged figures with crisp hair and the brahminical cord. These, a leper covered with ashes in the vestibule and an officiating priest, were all we saw.

Pilgrims were seen on various parts of the mount in very considerable numbers, passing from one temple to another, and leaving generally a few grains of dry rice at each; the rich and lame were carried in chairs, the poorer walk.

The culminant rocks are very dry, but in the rains may possess many curious things; a fine *Kalanchoe* was common, with the Barberry, a beautiful *Indigofera*, and various other shrubs; a *Bolbophyllum* grew on the rocks, with a small *Begonia*, *Telaginella*, *Davallia* and some other Ferns. There were no birds, and very few Insects, a beautiful small *Pontia* the only butterfly. The striped squirrel was very busy amongst the rocks, which, with some mice and the traces of bears, includes all I can say of the Zoology of the summit.

On the top and shoulders of the hill there is a considerable space for establishing a small Sanatarium, and the climate is no doubt highly advantageous, as is the proximity to Calcutta, and the acceptability of the country. Mainpath however, is probably a far more eligible site, equal or nearly so in altitude, much more extensive and only a night's dawk from the Grand Trunk Road. The height of the saddle I made to be 4,233 feet,* above the sea, and the following observations may

* Calculated by Daniell's Formula, for correcting the specific gravity of air by the Dew-Point. By Sir G. Shuckburgh's Formula, the height is 4,261.8 feet. Of the two Peaks visited the easternmost is 4,148.4, the flag-staff 4,348.2. feet.

give some idea of the temperature as compared with that of Calcutta and the plains below the mountain.

Comparision of Wooded-gully in Parus Nath.

Alt. 2,126 ft., with Plains at Base alt. about 1000 ft. and Calcutta at 9 A. M.

	Wooded-gully.		*Base.*		*Calcutta.*
Temp.	51.5	....	70.1	....	67.
D. P.............	36.7	....	37.9	....	38.8
Diff.	14.8	....	32.2	....	28.2
Saturation.	0.601	....	0.330	....	0.385
Elast. of vapour...	0.253	....	0.264	....	0.270

Interesting as the Botany of Parus Nath proved, its elevation did not produce such a change from the flora of its base as I had expected. This is no doubt due to the extraordinary influence of a dry atmosphere and barren soil. That the atmosphere of the summit is more damp as well as cooler than at the base, is proved as well by the observations as by the vegetation; the results of the former as compared with the means of those taken below are:

Comparison of Saddle or Crest of Parus Nath with Calcutta, and with the Plains at the base of the mountain, at 3 P. M. Feb. 4th.

	Parus Nath.		*Plains at foot of.*		*Calcutta.*
Temp.	54°.	....	75.5	....	74.4
D. P.............	21°.8	....	36.0	....	36.5
Diff.............	32°.2	....	39.5	....	37.9
Sat.	0.326	....	0.260	....	0.282
Vap. c. f.........	1.658	....	2.674	....	2.719
Elast.	0.150	....	0.248	....	0.252
Wind.	N.W.	....	N.W.	....	N. W.
Sky.............	Hazy.	....	Hazy.	....	Clear.

Of plants eminently typical of a moister atmosphere, I may mention the genera *Bolbophyllum*, *Begonia*, *Ferns*, *Æginetia*, *Disporum*, *Roxburghia*, *Panax*, *Eugenia*, *Myrsine*, *Shorea*, *Millettia*, the Mosses and foliacious Lichens; which appeared in uncomfortable association with such dry climate genera, as, *Kalanchoe*, *Pterospermum*, and the dwarf *Phœnix*. Add to this list the Barberry, *Clematis*, *Thalictrum*, 27 grapes, *Cardamine*, &c., and the mountain top presents a mixture of the

plants of a damp hot, a dry hot, and of a temperate climate, in fairly balanced proportions. The prime elements of a tropical Flora were however wholly wanting on Parus Nath, where are neither *Peppers, Pothos, Arum, Palms*, (except the starveling *Phœnix*,) tree ferns, *Scitamineæ* at this season, *Guttiferæ, Vitis* or *Laurineæ*.

In the evening returned to the village, I left early on the following morning, following Mr. Williams' camp who had gone on to Sheergottee.

In the valleys near the base of the hill were many fine trees, the *Buchanania latifolia* abounds, with large *Terminalias, Diospyros, Lagerstroemia*, and *Wrightea tinctoria*. A magnificent *Cæsalpinia (paniculata?)* hung in festoons over some of the trees, a perfect cataract of golden blossoms, relieved by a dark glossy foliage.

At Doomree (alt. 986 ft.) the hills are of gneiss, and hornblende schist, with a great deal of quartz; no palms or good trees of any kind. The curious genus *Balanites*, with *Ægle marmelos* form abundant bushes. The spear-grass is far too common for comforts in Botanizing.

Feb. 6th.—Left Doomree, walking, for Lieut. Beadle's Bungalow. The country around Baghodur is still very barren, but improves considerably in going westward, the ground becoming hilly and the road winding through prettily wooded valleys. *Nauclea cordifolia* is very common and resembles a young Sycamore. Crossing some well-bridged streams the road rises a good deal, and at the highest point measured 1429 ft. above the sea. The *Bombax*, (Semul) now leafless, is not uncommon, and a very striking tree from its buttressed trunk and gaudy scarlet flowers, swarming with birds, which feed from its honeyed blossoms.

At 10 o'clock the sun became uncomfortably hot, the Therm. being only 77°, but the black-bulb Therm. 137°. At noon arrived at Lieut. Beadle's at Belcuppee, from whom I experienced a most hospitable welcome. Staying there two days I enjoyed his society during several excursions to the hot spring, &c. I further profited much by his excellent knowledge of coloring and appreciation of the natural features of the surrounding country to which the beauty of its landscape is due. The most frequent trees are still the oak-like *Mahowa* (*Bassia*), *Nauclea*, Mango, and *Ficus infectoria*. These are all scattered however, and do not form forest, such as in a stunted shape, clothes the hills, and consists of *Diospyros, Terminalia, Gmelina, Nauclea parvifolia, Conocarpus*, &c.

The rocks are still hornblende schists and gneiss with a covering of

alluvium full of quartz pebbles. Effloresced salts are frequent in the exposed rocks, and probably inimical to *Lichens*, which though common hardly ever assumed the foliaceous form. Insects and birds are more numerous, with Jays, Crows, Doves, Sparrows and Maina (Pastor), also the *Phœnicophaus tristis*, (Mahoka of the natives,) with a voice like the English Cuckoo as heard late in the season.

Height of Belcuppee above the sea 1139 feet.

In the evening visited the hot-springs, situated close to the road. These are four in number, rise in as many little ruined brick tanks, about 2 yard across. Another tank, fed by a cold spring, about twice that size, flows between too of the hot, and only two or three paces distance from one of the latter on either hand.

All burst through the gneiss rocks, meet in one stream after a few yards, and are conducted to a pool of cold water, about 80 yards off, by bricked canals.

The temperatures of the hot springs were respectively 169°, 170°, 173° and 190°; of the cold, 84° at 4 P. M. and 75° at 7 A. M. of the following morning. The hottest is the middle of the five. The water of the cold spring is sweet but not good, and emits gaseous bubbles; it is covered with a green floating *Conferva*.

Of the four hot, the most copious is about three feet deep, bubbles livelily its gasses, boils eggs, and though brilliantly clear, has an exceedingly nauseous taste. This and the other warm ones deposit salt in a very concrete state, on the bricks and surrounding rocks.

Confervæ abound in the warm stream from the springs, and two species, one ochreous brown, and the other green, occur on the margins of the tanks themselves, and in the hottest water; the brown is the best Salamander, and forms a belt within the green: both appear in broad luxuriant strata, where the water is cooled down to 168° and below to 90°. Of flowering plants, three showed in an eminent degree a constitution capable of resisting, if not a predilection for the heat; these were *Cyperaceæ* all, a *Cyperus* and *Eleocharis?* having their roots in water of 100°, and where they are probably exposed to greater heat, and a *Fuirene?* at 98°; all were very luxuriant.

From the edge of the four hot springs I gathered seven or eight species of flowering plants, and from the cold tank five, which did not grow in the hot.

A water-beetle, *Colymbetes?* and *Notonecta,* abounded in water at 112°, with quantities of dead shells; frogs were very lively with live shells, at 90°, with various water beetles. Having no means of detecting the salts of this water, I bottled some for future analysis. The situation of these springs (called Sòorooch-kand) is very pretty, near the mouth of a valley. They are objects of worship of course, and a ruined temple is seen close behind, with three very conspicuous trees, a white thick stemmed and leafless *Sterculia,* whose ramuli bore dense clusters of greenish red, fetid and viscid flowers;—a Peepul and a Banyan.

On the following day I botanized in the neighbourhood with but poor success; an oblique-leaved *Ficus* climbs the other species and generally strangles them. Two other epiphytial *Orchideæ* occurred on the trees besides the one previously alluded to, an *Angræcum* and *Oberonia.* *Cuscutæ* of two species swarm over and conceal the bushes with their yellow filaments, especially choking the *Vitex Negundo? Mucuna* is common, and a most disagreeable intruder, the cowitch of its pod flying about with the wind and causing intolerable irritation.

February 8th.—Left Lieut. Beadle's early, following Williams' camp. The morning was clear and cold, the temperature only 56°; crossed the nearly empty broad bed of the Burkutta river, a noble stream in the rains, carrying along huge boulders of granite and gneiss.—Still ascending, measured the highest part of the road, 1492 feet, and suddenly came on a small forest of a peculiar looking tree, quite new to me. This proved to be the Indian Olibanum, *Boswellia thurifera,* conspicuous for its pale bark, and patent curving branches, leafy at the apices. Its general appearance is a good deal that of the mountain Ash; and the leaves, now copiously falling, and red in age, were actually reddening the ground. The gum was flowing abundantly from the trunk, very fragrant, clear and transparent. Many of the trees were cut down and had pushed leafy ramuli in great abundance from the stumps. The ground was dry and rocky with little other vegetation, no *Orchideæ* grew on the trees, and but little grass under foot. Kunkar here reappears in the alluvium. Another *Phœnix* occurred here, similar to, but different from the Parus Nath species, probably *Pacaulis;* it is wholly stemless, and I saw male flowers only.

Suddenly descending to the village of Burshoot, lost sight of the

Boswellia, and came upon a magnificent tope of Mango, Banyan and Peepul, so far superior to any thing hitherto met with, that we were glad to have hit on so pleasant a halting-place for a bivouac. There are a few lofty *Borassi* here too, great rarities in this soil and elevation; one about 80 feet high towered above some wretched hovels; displaying the curious proportions of the trunk in this tribe of Palm: first a short cone, tapering to one-third the height of the tree, the trunk then swells to two-third height, and again contracts upwards to the crown.

Beyond this, to Burree, the country ascends again, is tolerably wooded, but otherwise sterile and very dry. Burree (1275 feet) is a barren place, which we left at daylight on the morning of February 9th. So little to be observed that I had recourse to examining footsteps, the precision of which in the sandy soil was curious: looking down from the elephant I was amused to see them all in relief, instead of depressed, the slanting rays of the eastern sun producing this mirage: the effect was curious. Crossed another shoulder of a hill on this undulating road, at an elevation of 1524 feet, and descended to the broad stony bed of the Barrucker river, an affluent of the Dummoodah, and hence of the Hooghly. Except in some cotton cultivation, there was little to be seen, and before us no more of the wooded hills that had been our companions for the last 120 miles, and whose absence is a sign of the near approaching termination of the great hilly plateau we had traversed for that distance. Chorparun,* the next halt, is situated on an extended barren flat, 1311 feet above the sea, and from it the descent from the table-land to the plains below is very sudden.

February 10th.—At daylight left Chorparun, and descended the ghat or Dunwah pass, as it is called, to the great valley of the Soane, and to the level of that of the Ganges at Patna. The road, though very steep, is admirably carried zigzag down a broken hill of gneiss, with a descent of nearly 1000 feet in 6 miles, of which 600 is exceedingly rugged and steep. The pass is well wooded, with small trees, among which the *Boswellia* is conspicuous, now pushing its flowers from the leafless apices of the branches. Quartz and Felspar are the prevalent minerals, and barren enough in every respect, except supporting this low rugged wood and abundance of Bamboo; *Bombax*, *Cassia*, *Acacia*, and *Butea* are likewise frequent, as is a *Calotropis*, the purple

* Hill above Chuparun, 1322 ft.

Mudar, a very handsome road-side plant, which I had not seen before, but which, with the *Argemone Mexicana* was to be a companion for hundreds of miles before me. All the views in the pass are very picturesque, though wanting in good foliage, such as *Ficus* would afford, of which I did not see one tree. Indeed the rarity of the genus (except *F. infectoria*) in the native woods of these plains I have traversed, is very remarkable. The Banyan and Peepul appear, (as the tamarind and mango and Mahowa ?) always planted.

Dunwah, at the foot of the pass, is 633 feet above the sea, and nearly 1000 below the mean level of the highland I had left. Every thing bears here a better aspect; the woods at the foot of the hills afforded better botanizing; the Bamboo (B. stricta ?) is green instead of yellow and white; a little castor oil is cultivated, and the *Phœnix sylvestris* (low and stunted) appears about the cottages.

In the evening left Dunwah for Bahra, the next stage, over very barren soil, covered with low jungle, the original woods being apparently cut for fuel.

February 11th.—Left Bahra, alt. 477 feet (from one observation at sunrise only) at daylight, for Sheergotty,* where Mr. Williams was waiting our arrival. Wherever cultivation appears the crops are tolerably luxuriant, but a great deal of the country is very barren, yielding scarcely half a dozen kinds of plants to any 10 square yards of ground. The most prevalent were *Alax scandens*, two *Zizyphi*, and the ever-present *Acacia Catechu ?* and *Carissa carindas.* The climate is however considerably warmer and much moister, for I here observed dew to be formed, which I afterwards found to be usual on the low grounds. That its presence is due to the increased amount of vapor in the atmosphere I shall prove, the amount of radiation, as shown by the cooling of the earth and vegetation, being the same in the elevated plain and lower levels.

The following is an abstract of the Meteorological observations I was enabled to make. From these it is evident that the dryness of the atmosphere is its most remarkable feature, the temperature not being great, and to this, combined with the sterility of the soil over a great part of the surface, must be attributed the want of a vigorous vegetation. Though so favorably exposed to the influence of nocturnal radia-

* Alt. of road, at 284th mile-stone, 474 ft.

tion the amount of the latter is small. The maximum depression of a Thermometer laid on grass never exceeding 10°, and averaging 7°; the average depression of the dew point at the same hour amounting to 25° in the morning; of course no dew is deposited, even in the clearest star-light night, which I attribute in part to the extreme desiccation, and in part to the operation of the light haze alluded to above.

Table-land of Birbhoom and Behar.

	Temperature.				Wet Bulb.			Elasticity of Vapor.	Dew Point.					Weight of Vapor in cubic feet.	Saturation.			Number of observations.
	Mean.	Max.	Min.	Range.	Mean.	Max. Depression.	Min. Depression.		Mean.	Max.	Min.	Max. Depression.	Min. Depression.		Mean.	Max.	Min.	
Sun-rise ..	56.6	65.2	46.3	18.9	48.2	12.5	6.0	.276	39.5	52.0	23.3	31.7	10.4	3.088	.550	.680	.330	7
9 A. M. ..	70.1	77.0	61.2	15.8	53.7	19.3	14.3	.264	37.0	52.7	24.5	39.2	24.3	2.875	.330	.450	.260	7
3 P. M.····	75.5	81.7	65.2	16.5	55.3	22.5	16.7	.218	36.0	46.8	24.3	48.4	34.9	2.674	.260	.320	.190	7
9 P. M.····	61.7	66.2	55.5	10.7	49.3	20.5	9.0	.248	36.1	50.0	*9.1	56.9	16.2	2.745	.410	.590	.340	10

Extreme variations of Temperature······················ 35°.4

,, ,, ,, Saturation························ 54.0

,, diff. between Solar and Nocturnal Radiation···· 96°.5

* Taken during a violent N. W. dust storm.

Table-land of Behar and Beerbhoom.

Solar Radiation.

Morning.					*Afternoon.*				
Time.	Th.	Black Bulb.	Diff.	Phot.	Tim.	Th.	Bla Bulb.	Diff.	Phot.
9½ A. M.	77.0	130	53.0	..	3½	81.7	109	27.3	..
10..........	69.5	124	54.5	10.320	3	80.5	120	39.5	10.320
10..........	77.0	137	60	..	3	81.5	127	45.5	10.330
9..........	63.5	94	30.5	10.230	3½	72.7	105	32.3	10.230
9..........	61.2	106	44.8	..	3	72.5	110	37.5	10.390
9..........	67.0	114	49.0	10.350	..	..	..	..	..
Mean.......	69.2	117.8	48.6	10.300	..	7 7.7	114.2	36.4	10.318

Table-land of Birbhoom and Behar.

Nocturnal Radiation.

	Sunrise.			Number of observations.	9 P. M.			Number of observations.
	Temperature.	Mean Diff. from Air.	Max. Diff. from Air.		Temperature.	Mean Diff. from Air.	Max. Diff. from Air.	
Exposed Th.	51.1	4.	9.0	6	56.4	5.3	7.5	7
On Earth.	48.3	2.5	3.7	3	53.8	4.9	5.5	6
On Grass.	46.6	6.2	9.0	5	54.4	7.2	10.0	7

On one occasion, and that at night, the dew point was as low as 9°.1, with a temperature of 66°, a depression rarely equalled at so low a temperature; this phenomenon was transient and caused by the passage of a current of air loaded with dust, whose cooling particles possibly absorbed the atmospheric humidity. I neglected to collect any of the powder. From a comparison of the night and morning observations of Thermometers laid on grass,—the earth,—and freely exposed, it appears that the grass parts with its heat much more rapidly than the earth, but that still the effect of radiation is slight, lowering its temperature but 2° below that of the freely exposed thermometer.

As compared with the climate of Calcutta these flat hills present a remarkable contrast, considering their proximity in position and moderate elevation.

The difference of temperature, deduced from the sunrise morning and afternoon observations, amounts to 4°, which, if the mean height of the hills where crossed by the road, be called 1133 feet, will be equal to a fall of one degree for every 288 feet. This is below the usual equivalent for that height: Playfair assuming, 1° equal to 270 feet of elevation, and more recent observers 1° as equal to 250 feet. A comparison of the solitary temperature taken at the top of Parus Nath with the cotemporaneous one at Calcutta, gives 1° of temperature for every 211 feet, which is again much above the assumed standard.

In the dampness of the atmosphere Calcutta contrasts very remarkably with these hills; the dew point on the Hooghly averaging 51°.3,

and on these hills 38°, the corresponding saturation points being 0.559 and 0.380.

The differences between sunrise, forenoon and afternoon dew points at Calcutta and on the hills, are 13°.6 at each observation; but the atmosphere at Calcutta is proportionably drier in the afternoon than at sunrise, than it is on the hills: the difference between the Calcutta sunrise and afternoon saturation point being 0.449: and the hill sunrise and afternoon, 0.190. The march of the dew point is thus the same in both instances, but owing to the much higher temperature of Calcutta, and greatly increased tension of the vapor, there the saturation points answering to these dew point temperatures, are very different.

In other words, the atmosphere of Calcutta is loaded with moisture in the early morning of this season, and is comparatively dry in the afternoon; in the hills again, it is scarcely more humid at sunrise than at 3 P. M. That this dryness of the hills is partly due to elevation appears from the disproportionately moister state of the atmosphere below the Dunwah pass.

A retrospect of the ground passed over is unsatisfactory, as far as botany is concerned, except as showing how potent are the effects of a dry soil and climate, upon a vegetation which has no desert types. At another season, probably many more species would be obtained, for of annuals I scarce got a score of species. In a geographical point of view the range of hills is exceedingly interesting, as being the N. E. continuation of a chain which crosses the broadest part of the Peninsula, from the gulf of Cambay to the junction of the Ganges and Hooghly at Rajmahal. This range runs south of the Soane and Vindhya, which it meets I believe at Omerkuntuk; the granite of this and the sandstone of the other, being then both overlain with trap. Further west again, the ranges separate, the present still betraying a nucleus of granite, forming the Satpur range, which divides the valley of the Taptee from that of the Nerbudda. The southern is, though the most difficult of definition, the longest of the two parallel ranges, the Vindhya continued as the Kymaon, terminating abruptly at the Fort of Chunar. The general and geological features of the two, especially along their eastern course, are very different. This of gneiss, hornblende-schists and granites, in various highly inclined beds, through which granite hills are pushed, most of them low, but one culminating

remarkably, Parus Nath, around whose base the overlying gneiss rocks dip, radiating from it. The N. E. Vindhya again are of flat beds of sandstone, presenting a dead level, with no eminences or signs of uphéaval, overlying a non-fossiliferous inclined bed of limestone. Between the latter and the Parus Nath gneiss, come (in order of super position) shivered and undulating strata of metamorphic quartz, horn-stone, hornstone-porphyry, jaspers, &c. These are thrown up, by volcanic action, along the N. and N. W. boundary of the gneiss range and are to be recognized, at the rocks of Colgong, of Sultangunge and of Monghyr, on the Ganges, as also various detached hills near Gya, and along the upper course of the Soane. From these the Soane pebbles are derived, which are equally common on the Curruckpore range, as on the south banks of the Soane:—so much so in the former position, as to have been used in the decoration of the walls of what are now ruined palaces near Bhaugulpore.

A very gradual ascent, over the alluvial plains of the west bank of the Hooghly, then over laterite, succeeded by sandstone of the Indian coal era, leads to the granite table-land properly so called; a little beyond this the latter reaches an average height of 1130 ft. which is continued on upwards of 100 miles, to the Dunwah Pass, in short. Here the descent is sudden, to the plains, which, continuous with those of the Ganges, run up the Soane till its valley is narrowed beyond Rotasghur. Except for the occasional ridges of metamorphic rocks mentioned above, and some intruded hills of greenstone, the lower plain is stoneless, its subjacent rocks being covered with a thicker stratum of the same alluvium, which is thinly spread over the higher parts of the table-land above, though even there collected in beds of enormous thickness in the depressions. The plain here dividing the Kymaon range from that of Parus Nath, is full 80 miles across, with a mere elevation of 400 ft.; beyond which the ascent to the Kymaon is more abrupt than 400 in the descent at Dunwah. This alluvium is, to my as yet unpractised eyes, a most remarkable formation, and with its inclosed kunker, appears as if deposited quietly and synchronously over the Kymaon, the Parus Nath range and the intervening broad valley of the Soane. Broad bold and headstrong as the latter river is, it seems to have played no part in the formation of its own valley, for in its upper bed, where the valley is scarcely two miles wide, and where the Kymaon sandstone

escarpments all but plumb the river, there is still a narrow strip of dead flat alluvium, with kunker, as hard and tough as many rocks, through which the river eats its way, cutting channels with perpendicular sides in both margins, and which shield the rocky hills on either bank. A thin bed of vegetable mould, the result of decomposition, or perhaps aided by occasional overflows of the stream, caps the alluvium; but the latter is distinctly a formation antecedent to the birth of the river. Of all problems referring more immediately to Indian geology, this appears to me the most interesting; whether we regard this vast deposit in a purely geological light or as that depression of hills and elevation of valleys, which has smoothed so much of the surface of the continent from the Himalayah to Cape Comorin, producing uniformity of outline and of concomitant features, over many thousands of square leagues, favoring the ravages of conquering races, and the propagation of creeds, of populations and industrial arts. On passing over the mountainous districts one is astonished at the isolation of the tribes, inhabiting the rugged hills of Curruck from Parus Nath and Rajmahal, but a uniformity prevails amongst the people north of the range, and along the Gangetic plains, from Benares to Monghyr, more marked than between any two neighbouring counties in England.

To return to the Parus Nath range (or table-land of north Bengal) it is the great water bed of this part of India. Rivers flow from it N. W. and N. into the Soane; the Rheru, the Kunner, the Coyle and innumerable smaller streams. A few insignificant nullahs also find their way to the Ganges. The more considerable ones debouche in the Hooghly, as the Dummoodah with its affluents, the Adji and Barrucker, the Cossye and Dalkissori; and still others, the Subunrika, Brahminy and north feeders of the Mahanuddy flow to the Bay of Bengal.

Hence, though difficult to define from its gradual slope to the eastward, its broken outline, (so different from the ghat ranges of sandstone or trap rocks,) and from the impracticable nature of the country forming its southern boundary, it is a range of great interest, from its being the source of so many important rivers, and of all those which drain the country between the Soane, Hooghly and Ganges—from its position directing the course of the Soane and forcing the Ganges which strikes its base at Rajmahal, to seek a sinuous course to the sea. In its climate and botany it differs equally from the Gangetic plains to the

north and from the hot damp and exuberant forests of Orissa to the south. Nor are its geological features less different, or its concomitant and in part resultant characters of agriculture and native population. Still further west than Mainpath, this range is continued, probably ascending, till it meets the Vyndhya at Omer-kuntuk, there the great rivers of the peninsula have their origin, these two ranges meeting and combining to throw of the waters mainly in opposite directions. The Nerbudda and Taptee hence flow west to the gulf of Cambay, the Cane to the Jumna, the Soane to the Ganges, and the northern feeders of the Godavery to the Bay of Bengal. Further west it appears to me that they again separate, but are still to be recognized by geological features, though these are masked by the presence in common to both of enormous overlying masses of trap.*

February 12*th*.—Left Sheergotty (alt. 463 ft.) crossing some small streams which, like all else seen since leaving Dunwah Pass, flow N. to the Ganges. Long low ranges of hills, isolated, and together forming no apparent system, rise abruptly out of the plain. These are chiefly of volcanic rocks, syenite and greenstone, forcing up, and sometimes injected through broken masses of gneiss, metamorphic quartz, hornstone, &c. All the rocks composing them are of excessive hardness and covered with a scanty vegetation, approaching absolute sterility. Many of them occurring between Sheergotty and the Soane, are better known to the traveller from having been telegraphic stations. Some are much impregnated with iron, and whether for their color, the curious outlines of many, or their position, they form quaint, and in some cases picturesque features in the otherwise tame landscape.

At Muddunpore alt. 442† ft. a thermometer, sunk 3 ft. 4 inches in

* I laid these views when very crude before my friend and present host B. H. Hodgson, Esq. and received such assistance in fixing them as few could afford. I am anxious, thus early, to record my deep sense of obligation to one who is my master in the Physical Geography of Asia, because, living as we are in constant intercourse, and entertaining views, so consonant on enquiries of this nature, the pupil is apt to forget, how much the results of his own efforts are enhanced in value by the directing hand of his preceptor.

† I need hardly say that I hope for the indulgence of the Indian Geographer during his perusal of this sketch. It is given with the view of eliciting contradiction or confirmation, and perhaps with too much of that confidence which my superficial knowledge of a great part of the country in question inspires. One end will have

the soil maintained a constant temperature of 71.5°, that of the air varying from 77.5 at 3 P. M. to 62. at sunrise.

Road to Nourunga highly cultivated, with the *Phœnix* more abundant, and many of the weeds of the cultivated grounds, the analogues of the corn-field plants of England, and in many cases the same genera, and almost universally belonging to the same natural order, as *Labiatæ*, *Scrophularinæ*, *Solaneæ*, *Leguminosæ*, and *Boragineæ*, *Caryophylleæ*, *Veronica*, *Anagallis* and *Graphalium luteo-album*; both the latter very prevalent European weeds, were abundant, and are amongst the few English plants common to India. The ground in some places was spangled with the blue flowers of the beautiful *Exacum tetragonum?* as English upland meadows are often with its ally *Gentiana campestris*. At 312 milestone the elevation of the road from one morning observation is 371 ft.

At Nourunga I sunk two Thermometers in partial shade of Palms. One at 3 ft. 8 in., the other at 4 ft. 8 in., with the following results:

Time & Temp. of Air.	*Shade.*	at 3 ft. 8.	at 4 ft. 8.	Temp. at 3 P. M.
Feb. 13th, 9 P. M.	60	71.0	71.5.	of the same day 71°
10 P. M.	60	72.0	72.0.	Maxm. of bk. bulb
14th, 5 A. M.	57	70.	71.5.	Thermometer 119°.

At 5 A. M. I took the temperature of the earth at lesser depths.

Surface soil,	53	The elevation of Naurunga is 342 feet, and the
1 Inch.	57	soil bored into, was an excessively tough allu-
2 „	58	vium which however seemed to part with
4 „	62	its heat from nocturnal radiation very rapidly.
7 „	64	The three observations at 3 feet 8. and 4 feet 8.

been served should it lead other travellers and enquirers to group geographical features. A stranger in India is overwhelmed with local details. In no British possession have I found a community so conversant with the local geography of that whole country, of which each individual can see but little; none where a new comer may accumulate information so rapidly, so accurately, and I may add without flattery, so pleasantly. But still the broad features are neglected, the dependence and direction of the rivers upon the elevation and disposition of the land, the connection of those with geographical phenomena, of more remarkable simplicity in India than in any similarly extensive country, and the possibility of arranging a knowledge of details by a due regard to the bearings of all these. Very many can indicate with precision the position of an untold number of towns and the mouths of so many rivers, but how few will point the finger to Omer-kuntuk if asked for the fountain-head of all the great cis-Himalayan streams, though these span an area of 10 degrees of latitude and 16 in longitude.

are not sufficient to draw any conclusions from, but they appear to indicate the transmission of solar heat accumulated during the day downwards, between 9 P. M. and sunrise of the following morning.

February 14th.—Marched from Naurunga to Barroon on the Soane, crossing several streams, one deep. It is curious that all the streams between the Dunwah pass and the Soane itself run parallel to that river and into the Ganges, even the westernmost of them, as the Pompon, some of whose feeders at the great trunk road, run parallel to the Soane, within a mile of that river, but instead of finding their way to it, seek a northward course of nearly 100 miles to the Ganges. This indicates a more rapid fall of the land towards the N. than to the W., and further, a depression between Dunwah and the Soane, which I believe occurs about Naurunga, and from whence there is a rise towards the Soane. Nothing can more clearly indicate the tenacity and durability of the alluvium through which the small streams wind their way. The body of water lodged in this depression would else, during the rains, find a course into the Soane, instead of keeping parallel to it for so many miles. The fall of the Soane itself however gives the northerly dip of the land towards the Ganges more clearly. My observations both at Barroon on the E. and at Dearee on the W. bank (opposite) of the Soane, makes the river here about the same level as that of the Ganges at Benares, which Prinsep estimates at 300 feet above Calcutta. Now the length of the Ganges between Benares and the mouth of the Soane is about 150 miles, with a fall of as many feet. The length of the Soane between Barroon and the Ganges is 70 miles with a fall of upwards of 150 feet,* producing of course a current most unfavorable to navigation.

Barroon is situated on the alluvial bank of the river (elevated 345 feet) and on as naked and barren a looking country as well may be, the broad expanse of sand which the river exposes in the dry season, resembles a desert, which like many other similar expanses of sand on the Ganges, has its mirages, its simooms, and the other phenomena of an

* All these elevations are above the sea, must be considered as mere approximations, and are intended to give the general outline of the land. Had I detailed surveys of the countries in question, they would of course have been preferred to my own very rough geodetical operations, and which were not taken with the view of determining levels primarily.

Australian or African desert to a miniature. Its surface in the day is heated above that of the neighbouring country, at night cooled below it. The stars appeared to twinkle more clearly on its banks, and I thought I could during the early morning detect a current of air flowing from its cooled atmosphere to that surrounding the warmer alluvial plains. *Rhamneæ, Carissa, Olax, Acacia, Menispermun* and a tall stiff and dry *Malva,* formed the pervailing vegetation, with *Cuscuta, Cassytha,* a few *Asclepiadeæ* and withered grass. Though this is the coldest season, the sand was heated to 110° and upwards where sheltered from the wind, and to 101° on the broad bed of the river.

To compare the rapidity and depth to which the heat is communicated by pure sand, and by the tough alluvium, I took the temperature at some inches depth in both. The mean of a good many observations at different holes, gave the following differences between the temperature of a column of sand in situ 16 inches thick, at 2 P. M. and 5 A. M. the following morning.

Feb. 14th 2 P. M.		15th, 5 A. M.	Diff.	
Air in shade,	81°	62	18°	Maximum of black-bulb therm. during the day 126°.
Surface,	108	43	64.5	Min. of radiation at 5 A. M. from a naked bulb therm.
1½ inch, ..	100	50	50	48.2. (exposed over the sand).
3½ ,,	85	57	28	
6 ,,	73	67	6	
16*	72*	68	4	

* Sand wet at this depth.

That the alluvium both conducts the heat better, and retains it longer, would appear from the following, the only observations I could make owing to the tenacity of the soil.*

Hard alluvial bank of river.

2 P. M. Surface 104°.
2½ inch, 93°.
5 ,, 88°. Sand at this depth, 78°.
5 A. M. Surface 51°.
28 inches, 68°.5.

* The plan I adopted was suddenly to remove a large clod of alluvium and insert a very small thermometer bulb into a perpendicular side of the hole thus made. I should be glad that any one could suggest to me a better method, feasible for a traveller. The increment or decrement of heat is so rapid for a few inches below the surface as to render its determination with any accuracy very difficult.

Hence the difference between the heat of the surface of the alluvium and of the same at 5 inches is, 16° during the day, but of a similarly disposed column of sand, 30°.

During the night again a column of 28 inches of alluvium presents a difference of 17°.5, one of sand as nearly as I could ascertain of 16 inches, 24°.5.

This effect of sandy deserts in causing extremes of heat during the day, and cold at night, is thus readily to be apprehended, and in the case of the larger area covered with sand, the effect of radiation is probably much increased. Thus in the desert between Cairo and Suez a surface heated in the middle of December to 90° during the day, presented on the following morning, before sunrise, a dewed surface of 47°.5, the increment of heat in digging down to 10 inches was 9 degrees: so powerful is then the effect of nocturnal radiation, that a column of 10 inches was cooled at its base to within 9 degrees of its exposed surface; while a similar one on the Soane had its base temperature 24° above that of the surface, &c.

Observing the flowing sap of a vigorous *Calotropis* plant growing in the sand to maintain a temperature of 72° in spite of the great heat of the surrounding soil, I dug about its roots and obtained that temperature at 78 inches where the sand was wet, and from whence its roots derived their moisture. As at 15 inches the temperature was still only 72° and its roots did not appear to descend so deep, it is evident that the plant was pumping up moisture with such rapidity as to bring the fluid to the surface as cool as below. That this coolness of the sap is due to the ascending currents, is proved by taking the temperature of the leaves, which were at 80° (constants).

The low temperature of the leaves exposed to the sun (which heated the sand to 110° and earth to 104°) is probably due both to the coolness of the ascending sap and evaporation from the leaf's surface, as the activity of the circulation is regulated by the rapidity of evaporation. On the same night the leaves were cooled to 54° by radiation, the sand to 51°, and before sunrise on the following morning the *Calotropis* showed 45°.5 and the sand 42°. I neglected to observe the temperature of the sap at this time, but supposing it to be that of the earth at the same depth (15 inches) which was 68°, we must admit the leaves to be heated only 8° by solar radiation and cooled 22°.5 by nocturnal.

Two thermometers sunk in the alluvium here gave the following results:—

The air.	Soil at 3 ft. 6.	Soil at 2 ft. 4.	In both cases
9 P. M. 62°	70°	70°	perfectly ex-
11 P. M.	72	72	posed hard al-
5½ A. M. 53.5.	48.5.	68.5.	luvial soil.

Here again, as at Nourunga, there is a decided increase of temperature after 9 P. M. I cannot suppose however, that it is due to a heating of the soil to that depth, so rapidly as the 9 and 11 o'clock observations would seem to indicate.

February 15*th*.—Crossed the Soane to Dearee on the opposite bank; at this season there is but little water and the body of the current runs close to the W. shore; all else is sand, representing in its major and minor undulations those of the ocean. The progressive motion of the waves was very evident, and produced by the sand from windward flying off one ripple and heaping against the weather bank of the ripple to leeward; thus though the particles of sand preserve an onward course, the waves are advancing against the wind or retrograding, that in front being added to on its weather side. A few islets of laminated sand occur in the bed of the sand, little oases, green with waving crops of much diseased wheat and barley. Alt. of Dearee 334 ft.

February 16*th*.—From hence our course lay up the Soane, leaving the grand trunk road. Marched from Dearee this morning to Tilothi, through a rich and highly cultivated country, covered with indigo, cotton, sugar-cane, *Carthamus*, castor oil, poppy, and various grains. The *Zizyphi* are larger, *Cuscutas* cover even tall trees with a golden web, and the *Capparis acuminata*, was in full flower along the road side. Tilothi, a beautiful village situated in a magnificent tope, is close to the river, and about 5 miles from the foot of the Kymaon, which here presents a precipitate sandstone escarpment. The plants along its base were precisely the same as those of the Dunwah pass, and on their tops those of the base of Parus Nath: *Buchanania*, *Boswellia*, *Terminalias*, *Acacias*, *Bauhinia* and the white-trunked naked-armed *Sterculia fœtidissima*.

A hole was sunk here again, for the thermometers, and as usual, with great labour; 8 men took as many hours to bore 5 ft. with a very heavy iron *jumper*, so exceedingly tough is the soil;—the temperatures obtained were—

Air.		4 feet 6 inches under good shade of trees.
9 P. M.	64°5	77°
11 P. M.	....	76°
$5\frac{1}{2}$ A. M.	58°5	76°

This is a very great rise (of 4°) above any of those previously obtained, and certainly indicates a much higher mean temperature of the locality. I can only suppose it due to the radiation of heat from the long range of sandstone cliff, exposed to the south, which overlooks the flat whereon we were encamped, and which though 4 or 5 miles off, forms a very important feature. The differences of temperature in the shade taken on this and the other side of the river are 2°8 higher on this side.

February 17*th*.—Proceeded up the Soane to Rotasghur, where a spur of the Vindhya stands abruptly forward.

The range, in proceeding up the Soane valley gradually approaches the river, and beds of limestone are seen protruding below the sandstone and occasionally rising into rounded hills, the paths upon which show as white as do those through the chalk districts of England. The overlying beds of sandstone are nearly horizontal, or with a dip to the N. W.; the subjacent ones of limestone dip at a greater angle. Before coming to the village of Akbarpore, at the base of the spur, the road passes over the foot of a curious detached conical hill of limestone, capped with a flat mass of sandstone, whose edges, from the more rapid decomposition of the subjacent support, overhung the top of the hill. At its base the beds of some are undulating and an anticlinal line is passed over; beyond this the escarpment of the Vindhya sweeps backwards from the river, and returns as the spur of Rotas, which thus forms one horn to a grand amphitheatre of rocks, enclosing a wooded valley. The forest creeps up the sloping base of the precipices, whose crests are shaggy also with a rough jungly wood. This view of the conical hill with its sandstone cap, the grand sweep of the scarped rocks, returning to form the fortress-crowned spur of Rotas, and the foreground of wooded valley, is exceedingly fine.

During my stay at Akbarpore we had the advantage of the society of C. E. Davies, Esq. who was our guide and instructor during some rambles in the neighbourhood, and to whose experience, founded on the best habits of observation, I am indebted for excellent informa-

tion. On our excursion to the top of the hills, we passed one of those beautiful built wells, about 60 ft. deep, and with a fine flight of steps to the bottom. Now neglected and overgrown with flowering weeds and creepers, it afforded me many of the plants I had only previously obtained in a withered state; it was curious to observe there some of the species of the hill tops, whose seeds doubtless are scattered abundantly over the surrounding plains, and only here find a congenial climate, where the coolness and moisture of their natural level are imitated. A fine fig tree growing out of the stone work spread its leafy green branches over the well mouth, which was about 12 ft. square; its roots assumed a singular form, enveloping two sides of the well walls, with a beautiful network, which at *high-water mark*, (rainy season) abruptly divides into thousands of little brushes, dipping into the water which they fringe, thence descending to the earth below. It was a pretty cool place to descend to, from a temperature of 80°, above, to 74° at the bottom, where the water was 60°; and most refreshing to look, either up the shaft to the green fig shadowing the deep profound, or along the sloping steps through a vista of flowering herbs and climbing plants, to the blue heaven of a burning sky.

The ascent to Rotas is over the dry hills of limestone, covered with a scrubby brush-wood, to a crest where are the first rude and now ruined defences of the pass. The limestone is succeeded by the sandstone cliff cut into steps, which leads from ledge to ledge of the strata, and gap to gap, well guarded with walls and archways of solid masonry. Through this you pass on the flat summit of the Kymaon hills, covered with grass and low loose forest, amongst which paths run in all directions. The ascent is about 1200 ft. a long pull in the blazing sun, even of February. The turf is chiefly of spear-grass and *Nardus*, which yields the favorite oil, much used in domestic medicine all over India. The trees are of the kinds mentioned before, especially the *Olibanum*, *Wrightea*, *Diospyros* and *Terminalia*; the Sal (*Vatica robusta*) is rare, from being universally cut down. The curious *Hymenodyctium thyrsiflorum* grows as a scattered tree. A pretty octagonal summer-house with a roof supported by pillars, occupies one of the highest points of the plateau; it is called 1485 ft. above the Soane, and commands a superb view of the features mentioned before.

From this to the palace is a walk of 3 miles, through the woods.

The buildings are very extensive, and though now ruinous, bear evidence of great beauty in the architecture: light galleries supported by slender columns, long cool arcades, screened squares and terraced walks, are the principal features. The rooms open out into flat roofs, commanding views of the long endless table-land on one side, and a sheer precipice of 1000 feet on the other, with the Soane, the amphitheatre of hills, and village of Akbarpore, below.

This and Bidjegur, higher up the Soane, were some of the most recently reduced forts, and this was further the last of those wrested from Baber in 1542. Some of the rooms are still habitable, but the greater part are ruinous and covered with climbers of both wild flowers, and the naturalized garden plants of the adjoining shrubbery. The *Nyctanthes* and *Guettarda*, with *Vitex negundo*, *Hibiscus abelmoschus*, *Abutilon indicum*, *Physalis*, *Justicia adhatoda* and other *Acanthaceæ*, and above all the little yellow-flowered *Linaria ramossima*, crawling like the English *L. cymbalaria* over every ruined wall: all this is just as we see the walls of our old English castles harbouring to the last the plants their old masters fostered in the garden hard by.

On the limestone walls several species of crustaceous *Lichens* abounded.

In the old dark stables I observed the soil to be covered with a copious most evanescent efflorescence, apparently of Nitrate Lime, like soap-suds scattered about.

I made Rotas Palace 1576 feet above the sea, or 1177 feet above the village, so that this table-land is here only 50 feet higher than that I had crossed on the Grand Trunk Road, before descending at the Dunwah pass. Its mean temperature Mr. Davies informs me, is probably about 10° below that of the valley below, but, though so cool, not exempt from agues after the rains. The extremes of temperature are less marked up here than below, where the valley becomes excessively heated, and where the hot wind sometimes lasts for a week, blowing in furious gusts.

The climate of the whole neighbourhood has changed materially; and the fall of rain, which has much diminished, consequently on felling the forests; even within 6 years the hail-storms are far less frequent and violent. The air on the hills is highly electrical, owing no doubt to the dryness of the atmosphere, and to this the frequent formation of hail-storms may be due.

The Zoology of these regions is tolerably copious, but little is known of the natural history of a great part of the plateau; a native tribe, prone to human sacrifices, is talked of. Tigers are far from unfrequent, and bears numerous, they have besides the leopard, panther, viverine cat, and civet. Of the dog tribe the pariah, jackal, fox, and wild dog called Koa. Deer are very numerous, of 6 or 7 species. A small alligator inhabits the hill streams, a very different animal from either of the Soane species.*

During our descent we examined several instances of ripple mark in the sandstone; they resembled the fluting of the *Sigillaria* stems, in the coal-measures, and occurring as they did here, in sandstone a little above great beds of limestone, had been taken for such, and as indications of coal.

On the following day we visited Rajghat, a steep ghat or pass up the cliff to Rotas Palace, a little higher up the river. We took the elephants to the mouth of the glen, picking up Mr. Davies in our way, who had taken his *usual* before break-fast walk, of from Akbarpore to the top of Rotas! and down by the Rajghat pass. Dismounting we followed a stream abounding in small fish and aquatic insects, *(Dytisa* and *Gyrini)*, through a close jungle, to the foot of the cliffs, where there are indications of coal. The woods were full of monkeys, and amongst other plants I observed *Murraya exotica*, but scarce. Though the jungle was so dense the woods were very dry, no Palm, *Aroideæ*, Peppers, *Orchideæ* or Ferns. Here, at the foot of the cliffs, which towered imposingly above as seen through the tree tops, are several small seams of coaly matter in the sandstone, with abundance of pyrites, sulphur and copious efflorescences of salts of iron: but no real coal. The springs from the cliffs above, are charged with lime, of which enormous tuff beds are deposited on the sandstone, full of impressions of leaves and stems of the surrounding vegetation. In some part of their course the streams take up quantities of the efflorescence, which are scattered over the sandstones in a singular manner.

At Akbarpore (alt. 399 ft.) I had sunk two thermometers, one at the depth of 4 feet 6 inches, the other 5 feet 6 inches, which both indicated 76° during the whole time of my stay, the air varying at the surface

* For the better part of this information and much other of value, whose insertion would cause this paper to exceed its proper limits, I am indebted to Mr. Davies.

from 56° to 79°.5. Dew has been formed every night on the plains since leaving the hill at Dunwah, the grass being here cooled 12° below the temperature of the air.

February 19th.—Marched up the Soane to Tura, passing some low hills of limestone, between the cliffs of the Kymaon and the river. Collected *Ulmus integrifolia*, a small *Clerodendron*, and pretty bell flowered Asclepiadeous plant crawling over the hedges. Botanized on the banks of the river, which is lined with small trees of *Ficus*, *Terminalia*, *Phyllanthus*, *Trophis*, and various shrubs, one, a very sweet-scented Vitex, with clusters of white flowers, also *V. agnus-castus?* (or Negundo.) On the shaded banks, abundance of a *Myosotes* like *Cynoglossum*, *Veronicæ*, *Potentilla*, *Ranunculus sceleratus*, *Rumex*, several herbaceous *Compositæ* and *Labiatæ*; *Tamarix* formed a small bush in rocky hillocks in the bed of the river, and in pools several aquatic plants, *Zanichellia*, *Naias*, *Chara*, and a pretty little *Valligneria*, and *Potamogeton*. *Riccia* was very abundant. The Brahminy goose was common here, and we usually saw in the mornings immense flocks of wild geese overhead, flying. North elevation of Tura 443 ft.

Here I tried again the effect of solar and nocturnal radiation on the sand, at different depths in the sand, not being able to do so on the alluvium. Temperature of air 87°.

	Noon.	Daylight of following morning.
Surface*	110°	52°
1 inch	102°	55°
2 ditto	93°5	58°
4 ditto	84°	67°
8 ditto	77° Sand wet	73° wet
16 ditto	76° ditto	74°

As from above Tura the Soane valley narrows very rapidly, I shall give here an abstract of the Meteorological observations taken since leaving the Dunwah Pass.

The difference in mean temperature, (partly owing to the sun's approach) amounts to 2°5 of increase on the Soane valley, above that of the hills. The range of the thermometer from day to day was considerably greater in the upper station (though fewer observations were

* Thermometer employed not registered above this temperature.

there recorded) amounting to 17.2 in the former and only 12°8 in the lower station. The range from the maximum to the minimum of each day amounts to the same in both, above 20°. The extreme variations in temperature too coincide within 1°4.

In the hygrometric state of the atmosphere, this of the plains differs most decidedly from that of the hills. Here, as I remarked, dew is constantly formed, which is owing to the amount of moisture in the air, for nocturnal radiation is more powerful on the hills, though it never caused a thermometer to descend to the dew point there. The sunrise and 9 P. M. observation on the lower level give a mean depression of the D. P. below the air of 12°.3, and those at the upper level of 21°.2, with no dew in the former case and a copious deposit in the latter. The corresponding state of the atmosphere as to saturation is 0.480 on the hills and 0.626 below. The only causes I can assign for this seem hardly sufficient: they are the more uniform depth and presence of the alluvium and the frequency of rivers; and what perhaps is even more powerful the shelter afforded by the Kymaon hills from the dry N. W. winds; though it is difficult to conceive that hills of only 1000 feet elevation can influence much a valley 80 miles broad (between the Kymaon and Dunwah.)

The vegetation of the Soane valley is exposed to less extremes of temperature, than that of the hills. The difference between solar and nocturnal radiation amounting here only to 80°.5, and in the former case to 96°.5. There is no material difference in the power of the sun's rays at the upper and lower level, as expressed by the black bulb thermometer, the average rise of a thermometer so exposed over one in the shade, amounting to 48° in either case, and the maximum occurring about 11 A. M. The decrease of the power of the sun's rays in the afternoon is much the most rapid in the valley, coinciding with a greater reduction of the elasticity of vapor and of humidity in the atmosphere.

The photometric experiments show a greater degree of sun's light on the hills than below, but there is not in either state a decided relation between the indications of this instrument and the black bulb thermometer. From observations taken elsewhere I am inclined to attribute the excess of solar light on the hills to their elevation; for at a far greater elevation I have met with much stronger solar light, in a very

damp atmosphere, than I ever experienced in the drier plains of India. In a damp climate the greatest intensity may be expected in the forenoon, where the vapor forms a thin and uniform stratum near the earth's surface; in the afternoon the lower strata of atmosphere are drier but the vapor is condensed into clouds aloft which more effectually obstruct the sun's rays. On the Birbhoom and Behar hills, where the amount of vapor is so small that the afternoon is but little drier than the forenoon, there is little difference between the solar light at each time. In the Soane valley again, where a great deal of humidity is removed from the earth's surface and suspended aloft, the obstruction of the sun's light is very marked.

I have given a few observations on the temperatures of the leaves of two plants during the night, *Argemone Mexicana* and *Calotropis procera*, to which I shall allude when more shall have been taken.

Dunwah to Soane River, and up Soane to Tura, Feby. 10th-19th.

	Temperature.				Wet. Bulb.			Elasticity of Vapor.	Dew Point.					Weight of Vapor in cubic feet.	S. Saturation.			Number of observations.
	Mean.	Max.	Min.	Range.	Mean.	Max. Depression.	Min. Depression.		Mean.	Max.	Min.	Max. Depression.	Min. Depression.		Mean.	Max.	Min.	
Sunrise,	57.6	62.0	53.5	8.5	51.7	8.5	3.8	0.352	46.1	53.6	40.6	16.9	7.0	3.930	.690	.787	.566	10
9 A. M....	74.0	81.0	63.5	17.5	59.5	18.5	4.0	0.382	48.5	56.7	30.0	33.5	6.8	4.066	.460	.818	.330	8
3 P. M....	77.6	87.5	71.0	16.5	59.9	26.0	6.8	0.357	46.4	60.0	36.0	44.2	11.0	3.658	.352	.703	.277	9
9 P. M....	64.5	68.7	60.0	8.7	55.5	12.5	2.5	0.370	47.5	55.6	41.0	24.1	4.4	4.014	.572	.990	.452	10

Extreme variation of Temperature .... = 34.0

„ „ „ Saturation .... = .623

„ diff. between Solar and Nocturnal Radiation = 80.5

Dunwah to Tura.
Nocturnal Radiation.

	Sun-rise.				9 P. M.			
	Temperature.	Mean Diff. from Air.	Max. Diff. from Air.	Number of observations.	Temperature.	Mean Diff. from Air.	Max. Diff. from Air.	Number of observations.
Exposed Th.	53.2	4.5	8.5	9	59.9	4.6	11.5	10
On Earth, ..	54.0	3.7	9.0	9	60.7	3.8	10.5	10
On Grass, ..	51.5	6.2	7.5	8	56.4	8.1	13.5	10

Dunwah to Tura.
Solar Radiation.

Morning.					Afternoon.				
Time.	Temp.	Black bulb.	Diff.	Phot.	Time.	Temp.	Black bulb.	Diff.	Phot.
9 P. M.	70.0	125	55.0	10.300	4 P. M.	76.5	90	13.5	..
11......	81.0	119	38.0	10.230	3	80.0	105	25.0	10.210
10¼	71.5	126	54.5	10.300	3	76.0	102	26.0	10.170
10......	72.0	117	45.0	10.220	3	87.5	126	38.5	..
10......	80.0	122	42.0	..	..	..	..	..	..
10½	78.0	128	50.0	..	..	..	..	..	..
Mean ..	75.4	122.8	47.4	10.262	..	80.0	105.7	25.7	10.190

Dunwah to Tura.
Nocturnal radiation from plants.

Sun-rise.					9 P. M.				
Air Temp. ..	Calotropis.	Diff.	Argemone.	Diff.	Temp.	Calotropis.	Diff.	Argemone.	Diff.
59.5	..	..	57.0	2.5	67.5	..	..	53.0	14.0
55.0	49.5	5.5	47.	8.0	67.	..	..	56.0	11.0
					64.3	58.5	5.8	57.0	7.3

February 20th.—From Tura we have again to cross our little army over the Soane, the Kymaon cliff approaching too near the river on this (W.) side, to allow of our passing along their base.

The river bed is very sandy, and about $1\frac{1}{2}$ mile across (apparently). I found the male *Vallisneria* flowers after a great search; it is impossible to distinguish them from the gnat's eggs, with which the pools swarm.

The stream was very narrow, but deep and rapid, obstructed with beds of coarse agate, jasper and chalcedony pebbles. A clumsy boat, here took us across to the village of Dumersolah (or Soanpore) a wretched collection of hovels. The crops thin and poor, and no palms or good trees. Squirrels however abounded, and were busy storing; descending from the trees they scoured across a road to a field of tares, mounted the hedge, took an observation, foraged and returned up the tree with their booty, quickly descended and repeated the operation of reconnoitering and plundering.

The bed of the river here is considerably above that at Dearee, where the mean of the observations with those of Barroon made it about 300 ft. The mean of these taken here and on the opposite side, at Tura, gives about 420 feet, indicating a fall of 120 feet in only 40 miles. Near this the sandy banks of the Soane are full of martins' nests, each one containing a pair of eggs. The deserted ones are literally crammed full of long-legged spiders, (Phalangium) which may be raked out with a stick and come pouring down the cliff like corn from a sack; the quantities are quite inconceivable. I did not observe the martin feed on them.

The entomology here resembled that of Europe, more than I had expected in a tropical country, where predacious beetles, at least *Carabildeæ* and *Staphylinideæ* are generally considered rare.

The latter tribes here swarmed under the clods, of many species too, but all small, and so singularly active that I could not give the time to collect well. In the banks again, the round egg-like earthy chrysalis of the *Sphinx Atropos?* and the many-celled nidus of the leaf-cutter bee were most common.

A large *Euphorbia (E. ligulata?)* is common all along the Soane and used every where (since leaving Dunwah) for fencing. I have not seen the *E. Indica;* and the *E. tereticaulis* very rarely since leaving Calcutta. The *Cactus* is nowhere here.

From this place onwards up the Soane, there is no road of any kind, and we must be our own road engineers. The sameness of the vegetation, and lateness of the season made me regret this; having expected both luxuriance and novelty in these seldom visited and never botanized wilds. Before us the valley narrows considerably, the forest becomes denser, the country in the S. side broken with rounded hills, and on the N. the noble cliffs of the Kymaon dip down to the river. The villages are smaller, more scattered and poverty-stricken, with the Mahowa and Mango as the usual trees: the Bangar, Peepul, and Tamarind being rare. The natives look more of a jungle race, are tall, athletic, erect, much less indolent and more spirited than the flat and listless natives of the plains.

February 21*st*.—Started at day-light: but so slowly and with such difficulty, through field and wood, and across deep gorges from the hills, that we only advanced five miles in the day, the elephant's head too was aching too badly to push, and the cattle will not advance when the draught is not equal. What is worse, it is impossible to get them to pull together up the inclined planes we cut, except by placing a man at the head of each of the 6, 8, or 10 in a team, and playing at *screwtail;* when the obstinate animal sometimes capsizes the vehicle. The small garrys and hackeries got on better, though it was most nervous to see them rushing down the steeps, especially those with our fragile instruments, &c.

Kosderah, where we halted, is a pretty place, elevated 473 feet, with a broad stream from the hills flowing past it. These hills are of limestone, and rounded, resting upon others of hornstone and jasper.

The camp was pitched by three small trees of Paper mulberry (I take it) which I had not seen before, and are scarce here.

Following up the little stream, gathered two species of *Potamogeton* and the *Vallisneria*, the latter forming an elegant green carpet in very rapid water, the corkscrew stems always on the stretch. Two *Æschynomynes* abounded, with a *Jussieua, Cyperus*, and several grasses. At the rapids the stream is crossed by large beds of hornstone and porphyry rocks, excessively hard, and pitched up at right angles, or with a bold dip to the N. The number of strata was very great, and of only a few inches or even lines thick; they presented all varieties of jasper, flint-rock, hornstone and quartz of various colours, with occasionally seams

of porphyry and Breccia. Hills of these rocks, and similarly heaved up, skirt the granite range of Parus Nath from the Ganges to as high up the Soane as we went, and perfectly similar rocks occurred again on the Ganges, at the N. of the same range in the islet rocks of Monghyr, Colgong and Sultanpore; they appear to form a deep bed, overlying the gneiss and granite above mentioned, and to be thrown up by the great range.

The numberless little rocks of the rapids were elegantly fringed with a fern I had not hitherto seen, probably *Polypodium proliferum*, and which is the only species the Soane valley presents at this season.

Returning over the hills, found the *Boswellia*, *Gmelina parviflora*, with the common trees of the heights, also *Hardwickia linata*, a most elegant leguminous tree, tall, erect, with an elongated coma and the ultimate ramuli pendulous, covered with bipartite leaves.

All the hills were covered with a shallow bed of alluvium, enclosing abundance of agate pebbles and kunker, the former derived from the quartzy strata above noticed.

At night the fires on the Kymaon hills blazed splendidly, the flames in some places leaping from hill to hill. In front of us a gigantic letter W. is written in fire.

February 23rd.—Start at daylight, moving the camp up the river with great difficulty to Panchadurmah (elev. 492 feet). High N. W. (the prevailing) wind generally commences at or before sunrise, and moderates at sun-down: this in the narrowed valley blows with very great force, and is so loaded with dust that the hills close by are often obscured: on their subsiding the atmosphere clears remarkably suddenly.

February 24th.—Following up the Soane to Pepurah, (elev. 517 ft.) the country wooded, very wild and picturesque; the Mahoowa tree and *Cedrela*, *Nauclea*, *Hardwickia* very abundant with *Terminalias*, *Pentapteris*, *Pongamia*, *Ehretia lævis*, a small tree, covered with white blossoms, and the new foliage deep green, shining and viscid. A fine *Strychnos* forms a dense foliaged tree, 30—60 feet high, some pale yellow, as if dying, others deep green, both in apparent health. *Feronia Elephantum* and *Ægle marmelos* very abundant, with various *Leguminous* and *Rubiaceous* trees; *Sterculia* and the dwarf *Phœnix*, which I have never found in fruit or indeed in flower except at Dunwah. Peacocks abound in the woods, and monkeys.

One of my garrys is broken hopelessly and advancing on the spokes instead of the tyre of the wheels. By the banks of a deep gulley here the rocks are well exposed, of shales resting on the limestone, which is nearly horizontal; and this again, unconformably on the quartz and hornstone rocks, which are confused and tilted up at all angles. In one place I observed the strata of the latter to run horizontally for a few feet, and suddenly to be turned up at right angles; with an arc less than a foot in span.

A spur of the Kymaon, like that of Rotas, here projects to the bed of the river, flaming at night with beacon-like fires of the natives, lighted to scare the tigers and bears from the spot where they cut wood and bamboo. The night was bright and clear, with much lightning, the latter attracted to the spur, and darting down as it were to mingle its flame with that of the forest; so many flashes appeared to strike on the flames, that it is probably the rarified air in their neighbourhood attracted it.

February 25th.—Awakened between 3 and 4 by a violent dust storm which threatened to carry away the tents. Our position at the mouth of the gulley, formed by the opposite hills, no doubt accounts for it. The gusts were so furious that it was impossible to observe the barometer, which I returned to its case on ascertaining that any indications of a rise or fall, in the column must have been quite trifling.

The night had been oppressively hot, with many insects flying about; amongst which I noticed a *Forficula*, a genus so rarely known to take to the wing in Britain.

At 8½ A. M. it suddenly fell calm, and we proceeded to Chahnchee (elev. 482 feet), the native carts breaking down in the passage over the projecting beds of flinty rocks, or as they hurried down the inclined planes we cut through the precipitous banks of the streams. Near Chahnchee passed an alligator, just killed by two men, a foul beast, about 9 feet long, of the Mager kind. More absorbing than its natural history was the circumstance of its having swallowed a child, that was playing in the water as its mother was washing her utensils in the river. The brute was hardly dead, much distended by the prey, and the mother standing beside it. A very touching group was this: the parent with her hands clasped in agony, unable to withdraw her eyes from the cursed reptile, which still clung to life with that tenacity for

which its tribe are so conspicuous; beside these the two athletes leaned on the bloody bamboo staffs, with which they had all but despatched the animal.

The *Butea frondosa* is abundantly in flowers here, and a gorgeous sight. In mass the inflorescence resembles sheets of flame, and individually the flowers are eminently beautiful, the bright orange red petals contrasting brilliantly against the jet-black velvety calyx.

By the river found two species of *Gnaphalium*, *Paronychia*, *Tamarix*, a dwarf *Acacia* like *Phyllanthus*, *Wahlenbergia*, *Campanulæ*, *Lepidium*, *Sagitalia?* *Vallisneria* and Docks (*Rumex Wallichii*) in abundance. Cumin and many other herbaceous plants; tortoises are frequent on the rocks, but pop into the water as approached.

The nest of the *Megachile* (leaf-cutter bee) was in thousands in the cliffs, with *Ephemeras*, *Caddis worms*, spiders and many predaceous beetles. Lamellicorn beetles are very rare, even *Aphodius*, and of *Cetoniæ* I did not see one.

The poor woman who lost her child earns a scanty maintenance by making catechu; she inhabits a little cottage, and has no property but two cattle to bring wood from the hills, and a very few household chattles, and how few of these they only know best who have seen the meagre furniture of Dangha hovels. Her husband cuts the trees in the forest and drags them to the hut, but he is now sick and her only boy, her future stay it was whose end I have just related. Her daily food is rice, with beans from the beautiful blue flowered *Dolichos*, trailing round the cottage, and she is in debt to the contractor, who has advanced two rupees to be paid off in three months by the preparation of 240 lbs. of catechu. The present was her second husband, an old man, by whom she never had any children, in which respect alone, did she think herself very unfortunate, for her poverty she did not feel. Rent to the rajah, to the police, and rates to the brahminic priest are here all paid from an acre of land yielding so wretched a crop of barley, that it more resembles a fallow field than a harvest. All day long the natives are boiling down the catechu wood cut into chips, and pouring the decoction into a large wooden trough, where it is inspissated.

This zillah is famous for the quantity of catechu its dry forests yield. The plant is a little thorny tree, erect, and bearing a rounded coma of well remembered prickly branches. Its wood is yellow, with

a dark brick-red heart, most profitable in January and useless in June, (for yielding the extract.)

February 27th.—Left for Hirrah, (elev. 536 feet) through a similar country to that passed yesterday. Rocks all highly inclined, often vertical, of ribbon-jasper quartz and hornstone; monkeys, parroquets and hornbills, pigeons, owls and flocks of peacocks. Found a leguminous tree very like the *Butea* in every respect, but with small white flowers (probably *B. parviflora*) so abundant as to appear as if snowed upon. A *Gardenia?* with large yellow fruit eaten by the natives. *Phyllanthus emblica, Kydia calycina* and the dwarf *Phœnix.*

February 28th.—Marched to Kotah (elev. 542 feet), the path leading over hills with the bed of flinty rock projecting every where, to the utter ruin of our vehicles and the elephant's feet, and then over undulating hills of limestone; on the latter found a tree of *Cochlospermum,* its curious thick branches spread out something awkwardly, and each is tipped with a cluster of glorious golden yellow flowers, as large as the palm of the hand, and very beautiful. I think Lindley is certainly right in referring it to *Cisteæ;* it is a tropical *Gum-Cistus* in features, produce, color and texture of petals, and their caducous frail nature. It is a superb plant. The bark abounds in a transparent gum, which the white ants seem fond of, for they have killed many trees here.

At Kota, a small village at the junction of the Soane (elev. 543 feet), beside a river of that name, we encamped, and experienced another furious dust storm from the N. W.

Scorpions appear very common here, of a small kind, 1½ inch long. Several were captured and one stung one of our party on the finger; the smart was burning for an hour or two, and then ceased.

February 29th.—Being now nearly opposite the cliffs at Bidgegurh, where coal is reported to exist we again crossed the Soane, and for the last time. The ford is some three miles up the river, to which we marched through deep sand. On the banks saw a species of *Celtis* or *Sponia* covered with lac. This tree is said to produce it here in greatest abundance, as the *Butea* does at Burdwan and the Peepul in many parts of the country. I do not know which yields the best, nor whether the insects are different. The merchants do not distinguish the kinds. The bed of the river is about ¾ mile broad, and the rapid stream 50 or 60 yards, and breast-deep; the sand firm and silicious, with no mica;

nodules of coal are said to be washed down here from the coal bed of Burdee, a good deal higher up, but we saw none.

The cliffs come close to the river on the opposite side, their bases wooded and teeming with birds. The soil is richer and individual trees, especially of *Bombax*, *Pentapteris* and *Mahowa*, very fine; one tree of the *Hardwickia*, about 120 feet high, was as handsome a monarch of the forest as I ever saw, and it is not often that one sees trees in the tropics, which for a combination of beauty in outline, harmony of color, and arrangement of branches and foliage, would form so striking an addition to an English park.

There is a large break in the Kymaon hills here, through which our route lay to Bidgegurh and the Ganges at Mirzapore, the cliffs leaving the river and trending to the N. in a continuous escarpment flanked with low ranges of rounded hills and terminating in an abrupt spur (Mungeza Peak) whose summit was covered with a ragged forest. Kunch, the village at which we halted is elevated 556 feet above the sea; four alligators basked in the river, like logs of wood at a distance, all of the short-nosed or Mager kind, dreaded by man and beast; I saw none of the sharp-snouted or Gharial, so common on the Ganges, where their long bills, with a garniture of teeth and prominent eyes peeping out the water, remind one of geological lectures and visions of *Ichthyosauri*.

Botanized over the ridges near the river, but found little novelty. The *Mahowa*, *Ehretia*, *Hardwickia*, *Gmelina*, and especially *Diospyros* and *Terminalia* are the prevailing timber; the *Cochlospermum* on the very hottest and driest ridges, imitating the *Cistus* in habit; (and like the *C. Ladanum*,) it is streaming with gum as was the *Mahoowa* and *Olibanum*. *Catechu* and *Rhamneæ* are ever present and ever troublesome to the pedestrian. *Phœnix acaulis* frequent, and in some places the woods appeared on fire from the bushes of *Butea frondosa* in full flower.

March 1st.—Left the Soane and struck inland over a rough hilly country, covered with forest, good 1000 feet below the tops of the Kymaon table-land, which, as I stated above, here recedes from the river and surrounds an undulating plain, some ten miles either way, facing the south. With nothing but narrow paths much contrivance and labour were required to get the carts on. In one place I descend-

ed to the empty bed of a mountain torrent, which had cut a perpendicular valley through at least 30 feet of alluvium. Thence we plunged into a dense forest, chiefly of the above mentioned trees, with *Zizyphi* and several species of *Acacia*; a *Pterospermum* different from the more common or Parus Nath species, together with that plant, occur in the woods, with dwarf *Bauhinias*, but neither *Ferns*, *Lichens*, mosses, *Orchideæ*, or other tribes of a damp climate. Our course was directed towards *Mungeza Peak*, a remarkable projecting spur or nose of the Kymaon, between which and a conical hill the path led. Whether on the elephants or on foot, the thorny *Zizyphi*, *Acacias*, &c. were most troublesome, and all our previous *scratchings* were nothing to this. The low hills are round-backed masses of sandstone, with beds of shale interposed, but no coal. Peacocks and jungle fowl are very frequent, the squabling of the former and hooting of the monkeys constantly grating on the ear; other birds were very common. From the defile we emerged on to an open plain, halting at the village of Sulkun, elevated 671 feet.

In the afternoon examined the conical hill, which, like that near Rotas, is of stratified beds of limestone, capped with sandstone. A stream runs round its base, cutting through the alluvium to the subjacent rock, which is exposed and contains oblate spheres of limestone. These spheres are from the size of a fist to a child's head, or even much larger, are excessively hard and neither laminated nor formed of concentric layers. What they are I cannot tell, but have seen similar spheres from the Silurian rocks of Wales. At the top of the hill the sandstone cap was perpendicular on all sides, and its dry top covered with small trees, especially of *Cochlospermum*. A few larger trees were of *Fici*, which clung to the edge of the rocks, and by forcing their roots into the intestines detached enormous masses, affording good dens for bears and other wild animals. From the top the view of rock, river, forest and plain, was very fine, the edge ranging over a broad flat girt by the scarped hills of the Kymaon. The latter were continued along the Soane banks, further west, in a rugged range of hills.

From Sulkun the isolated table-topped hill of Bidjegur is seen, with its one large tree and the Palace at top, but the distance is considerable.

We were delayed three days at Sulkun, from inability to get the carts, &c. on, and my time being precious, I here took leave of Mr. Williams and his hospitable companions and started for Mirzapore. Mr.

Felle, a gentleman attached to the Revenue department, whom I had the pleasure of meeting at Sulkun, kindly escorting me to his residence at Shugunj, and forwarding both myself and collections with camels and elephants.

Both the climate and natural history of this flat on which Sulkun stands, are similar to those of the banks of the Soane; the crops are wretched, as are the people (Koles), an athletic-looking race however, often armed with spear and shield. At this season the dryness of the atmosphere is excessive.

Before leaving the Soane valley to ascend the Kymaon portion of the Vindhya hills I shall give an abstract of the Meteorological observations taken since leaving Tura.

Valley of Soane river, Tura to Sulkun, Feby. 20th—March 3d.

	Temperature. Mean.	Temperature. Max.	Temperature. Min.	Temperature. Range.	Wet Bulb. Mean.	Wet Bulb. Max. Depression.	Wet Bulb. Min. Depression.	Elasticity of Vapor.	Dew Point. Mean.	Dew Point. Max.	Dew Point. Min.	Dew Point. Max. Depression.	Dew Point. Min. Depression.	Vapor in cubic foot.	Saturation. Mean.	Saturation. Max.	Saturation. Min.	Number of observations.
Sun-rise	56.0	70.0	50.0	20.0	52.5	10.0	1.5	.390	48.3	53.1	41.1	17.3	5.4	4.240	.754	.831	.570	12
9 A. M.	82.0	89.0	69.0	20.0	61.2	24.3	12.0	.385	48.7	60.2	40.3	45.2	22.9	4.007	.343	[illegible]	.226	11
3 P. M.	88.6	94.7	81.5	13.2	62.4	30.2	14.5	.289	40.8	50.9	32.3	57.2	25.1	2.975	.211	.309	.154	11
9 P. M.	68.0	74.0	61.0	13.0	56.8	15.0	6.0	.369	47.4	51.8	42.6	27.1	10.2	3.933	.511	.703	[illegible]	11

Extreme variation of Temperature 44.7

" " " Saturation .... .677

" diff. between Solar and Nocturnal Radiation ... 100

Tura to Sulkun.

Nocturnal Radiation.

	Sun-rise. Temperature.	Sun-rise. Mean Diff. from Air.	Sun-rise. Max. Diff. from Air.	Number of observations.	9 P. M. Temperature.	9 P. M. Mean Diff. from Air.	9 P. M. Max. Diff. from Air.	Number of observations.
Exposed Th.	51.7	4.1	8.0	9	61.2	6.8	10.5	10
On Earth.	52.4	3.4	7.0	9	64.3	4.6	8.5	9
On Grass.	48.8	7.0	11.5	9	55.8	11.8	17.0	9

Tura to Sulkun.

Solar Radiation.

Morning.					Afternoon.				
Time.	Temp.	Black Bulb.	Diff.	Phot.	Time.	Temp.	Black Bulb.	Diff.	Phot.
11½ A. M.	85.5	129	44.5	..	3 P. M.	85.5	116	30.5	..
10½	89.0	132	43.0	..	..	92.5	128	35.5	..
Noon.	90.0	132	42.0	10.140	..	92.0	120	28.0	..
"	85.0	130	45.0	..	..	89.5	128	38.5	..
"	86.0	138	52.0	..	..	93.5	144	50.5	..
"	90.0	138	48.0	..	..	..	..	..	..
Mean.......	87.5	133.2	45.7	10.140	..	90.6	127.2	36.6	..

Tura to Sulkun.

Nocturnal Radiation from Barley.

Sun-rise.							9 P. M.						
Temp. Air.	Barley.	Diff.	Calotropis.	Diff.	Argemone.	Diff.	Temp. Air.	Barley.	Diff.	Calotropis.	Diff.	Argemone.	Diff.
61.	56	5.0	56.5	4.5	57.0	4.0	68.5	..	..		..	56.0	12.5
57.	46	11.0	48.0	9.0	50.0	7.0	70.0	..	..	65.0	5.0	67.0	3 0
57.	52	5.0	..	..	50.0	7.0	69.0	..	..	57.0	12.0	57.0	12.0
58.5	52	6.5	..	..	..	..	74.	..	..	59.0	15.0	..	..
57.	52	[illegible]	..	..	..	..	62.5	51.5	11.0	..	..	..	..
50.	45	5.0	45.5	4.5	..	..	67.5	67.5	10.0	62.5	5.0	..	..
50.5	48	7.5	..	..	..	..	61.0	50.0	11.0	..	..	..	..
56.0	..	..	..	..	49.0	7.0							
55.8	49.8	6.0	50.0	6.0	51.5	6.2	68.	53.	10.7	60.9	9.2	60.0	9.1

The upper course of the Soane being in some places confined, and in others exposed to furious gusts from the gullies of the Kymaon hills, below Kotah, bounded by a continuous precipice of 1000 feet, and above it expanding into a broader and flatter valley, presents many fluctuations in temperature.

Exposed to the influence of radiation from so extended a surface, the mean temperature is much above that of the lower parts of the same valley (below Tura) the excess amounting to 5°.4. The nights and

mornings are cooler, by 1.2 degrees, the days hotter by 10°. There is also 10° increase of range during the 13 days spent there; and the mean range from day to day is nearly as great as it was on the hills of upper Bengal.

There being much exposed rock and the valley swept by violent dust storms, the atmosphere is drier, the mean saturation point being here 454°, and in the lower part of the Soane's course 516°. On the other hand the variation in the amount of moisture suspended in the atmosphere is more variable than even on the hills above alluded to; the accumulation of moisture in the calm nights and closer parts of the valley being great; it is rapidly swept away by the periodic dry wind of the day.

A remarkable uniformity still prevails in the depression of thermometers exposed to nocturnal radiation, whether laid on the earth, grass, or exposed to the influence of the sky alone; both the mean and maximum indication coincide very nearly with those of the lower Soane valley and of the hills. The temperature of tufts of green barley laid on the ground is one degree higher than that of short grass as it grows; *Argemone* and *Calotropis* leaves maintain a still warmer temperature; from the previous experiments the *Agemone* appeared to be considerably the cooler, which I was inclined to attribute to the smoother and more shining surface of its leaf, but from these there would seem to be no sensible difference between the radiating powers of the two plants.

Here, as on the hills, there is less difference between the forenoon and afternoon indication of the black-bulb thermometer, than in the more open valley, which is to be accounted for by my having been obliged to choose too late an hour for the forenoon observation.

The rapid drying of the lower strata of the atmosphere during the day, as indicated by the great decrease in the tension of the vapor and the saturation point, from 9 A. M. to 3 P. M. is the effect of the great violence of the N. W. winds.

March 3rd.—Rode to Roump, at the top of the pass in the hills called "Ek powa" (or one foot) ghat. The village of Markounda, at the foot of the ghat, is situated by a stream running over flat beds of limestone, fissured as to resemble a tessellated pavement; the fissures were filled apparently with volcanic matter, but the evening was too fast closing in to allow of my examining it. This, the only ascent to

the top of the hills for many miles around, is evidently the result of a fault, which has effected so broken an outline, that our path has been carried over the shattered crags. It is steep, rocky and covered with brushwood. On either side the precipices are sheer for many feet. At the summit we entered on a dead flat plain or, table-land with no hills, except along the brim of the broad valley we had left; where are some curious broad pyramids, formed of slabs of sandstone arranged in steppes.

March 4th.—Proceeded from Roump, which is about 400 feet above the plain, and 700 above the Soane, to Shahgunj, where I enjoyed Mr. Felle's hospitality for a few days.

The country here, though elevated is, from the nature of the soil and formation, much more fertile than what I had left. Water is abundant, both in tanks and wells, and rice fields, broad and productive, cover the grounds, tamarinds and mango topes now loaded with blossoms, occur at every village.

It is very singular that the elevation of this table-land (1103 feet at Shahgunj) should coincide with that of the granite range of upper Bengal, where crossed by the grand toll road, though they have no other feature but the presence of alluvium in common. Scarce a hillock varies the surface here, and the agricultural produce of the two is widely different. Here the flat ledges of sandstone retain the moisture, and give rise to none of those impetuous torrents which sweep it off the inclined beds of gneiss, or splintered quartz. Nor is there here any of the effloresced salts so forbidding to vegetation where they occur.

Wherever the alluvium is deep on these hills, neither *Catechu, Olibanum, Butea, Terminalia, Diospyros,* dwarf *Palm,* or any of this group of plants are to be met with, which abound wherever the rock is superficial, and irrespectively of its mineral or chemical characters, whether granite, gneiss, hornblende schists, hornstone, limestone or sandstone. On the other hand, the Banyan, Peepul, Mango, Tamarind, and even the Banana and Sugar-cane are found on the alluvium, though from the elevation and exposure these cannot attain the dimensions they do on the banks of the Ganges.

Acacia Arabica is abundant though not seen below, and very rare to the eastward of this meridian, for I saw but little of it in Birbhoom or Behar. It is a plant partial to a dry climate and rather prefers a good soil. In its distribution it in some degree follows the range of the

camel, which is its constant companion over thousands of leagues. In the valley of the Ganges I am told that neither the animal nor plant flourish east of the Soane, where I experienced a marked change in the humidity of the atmosphere on my passage down the Ganges. It was a circumstance I was interested in, having first met the camel at Teneriffe and the Cape Verd Islands, the westermost limit of its distribution; imported thither, however, as it now is into Australia, where, though there is no *Acacia Arabica,* 400 other species of that genus are known.

Mr. Felle's bungalow (whose garden smiled with roses in this wilderness) is surrounded by a moat, fed by a spring; it was full of aquatic plants, *Nymphæa, Damsonium, Villarica cristata, Aponogeton,* three species of *Potamogeton,* two of *Naias, Chara* and *Zannichellia* (the two latter indifferently, and often together, used in the refinement of sugar). In a large tank hard by, wholly fed by rain water, I observed only the *Villarica Indica,* no *Aponogeton, Nymphæa* or *Damasonium,* nor did these occur in any of the other tanks I examined, which were otherwise well peopled with plants. This may not be owing to the quality of the water so much as to its varying quantity in the tank.

All around here, as at Roump, is a dead flat except towards the crest of the ghauts, which overhang the valley of the Soane, and there the sandstone rock rises by steppes into low hills. During a ride to a natural tank amongst these rocky elevations, I passed from the alluvium to the sandstone steppes, and at once met with all the prevailing plants of the granite, gneiss, limestone and hornstone rocks previously examined, and which I have enumerated too often to require recapitulation, a convincing proof that the mechanical properties and not the chemical constitution of the rocks regulate the distribution of these plants.

Rujub-bund, (the name of the tank) is a small tarn, or more properly the expanded bed of a stream, for art has aided nature in its formation: it is edged by rocks and cliffs fringed with the usual trees of the neighbourhood; it is a wild and pretty spot, not unlike some birch-bordered pool in the mountains of Wales or Scotland, sequestered and picturesque.

Here again the *Aponogeton* and *Villarica cristata* grew, with several *Potamogetons, Chara, Zannichellia* and a floating *Utricularia.*

At 7 P. M. a tempest which had been gathering from the S. W. broke over Shahgunge, the lightning was very vivid, and the violence of the wind great. No rain fell, nor did the barometer indicate its approach. The day had been very close and sultry.

A columnar *Euphorbia, (E. ligulata?)* is commonly used here as a fencing, its pith is septate, a curious character, generally supposed to be peculiar to the pith of the Walnut tree. This is a matter of some interest, a fossil plant of the coal formation having been refered to the family of the Walnuts solely from its presenting this character.

One of the prettiest optical phenomena I have witnessed is frequent in the clear skies of these elevated regions: that of the false sunrise and sunset, often consisting of beams converging from the opposite horizon and meeting at the zenith the direct sun's rays. I have seen it equally vivid against a pure blue sky and against dark lowering clouds. The zodiacal light also shines with peculiar brightness, almost outshining the milkyway at times.

From the few days' observations taken on the Kymaon hills the temperature of their flat tops may be regarded as 5° higher than that of the valley, which is 500 feet below their mean level. I can account for this anomally only on the supposition that the thick bed of alluvium, freely exposed to the sun and not clothed with jungle, absorbs the sun's rays and parts with its heat slowly. This is indicated by the increase of temperature being due to the night and morning observations, which are 3°.1 and 8°.5 higher here than below, whilst the two of 9 A. M. and 3 P. M. are half a degree lower. What little alluvium there is on the Soane banks along its upper course is covered with jungle, thus excluding the solar rays, whilst the disproportionate amount of sterile rock rapidly parts with its heat and reduces the nocturnal temperatures. The vastly superior vegetation, both arboreous and herbaceous, of the Kymaon hills, is conclusive in favor of their superior soil and climate.

Table-land of Kymaon Hills, March, 3d-8th, 1848.

	Temperature.				Wet Bulb.			Elasticity of Vapor.	Dew Point.					Vapor in cubic foot.	Saturation.			Number of observations.
	Mean.	Max.	Min.	Range.	Mean.	Max. Depression.	Min. Depression.		Mean.	Max.	Min.	Max. Depression.	Min. Depression.		Mean.	Max.	Min.	
Sun-rise. ..	65.3	69.0	57.5	11.5	57.7	8.0	6.0	.428	52.0	55.5	45.9	14.1	11.6	4.710	.647	.741	.648	4
9 A. M....	81.6	83.5	79.5	4.0	65.3	19.0	14.0	.468	54.5	57.9	49.0	12.9	33.0	5.000	.421	.479	.344	3
3 P. M.....	88.1	90.0	84.5	5.5	63.3	26.5	21.5	.324	43.7	47.8	37.9	46.6	42.2	3.417	.240	.295	.214	3
9 P. M....	71.1	76.0	68.0	8.0	60.3	13.0	8.3	.433	52.3	56.7	46.8	21.9	13.8	4.707	.542	.643	.491	4

Extreme variation of Temperature .... = 32°.5
,, ,, ,, Saturation .... = .527
,, diff. between Nocturnal and Solar Radiation = 110°.5

Table-land of Kymaon.
Nocturnal Radiation.

	Sun-rise.				9 P. M.			
	Temperature.	Mean Diff. from Air.	Max. Diff. from Air.	Number of observations.	Temperature.	Mean Diff. from Air.	Max. Diff. from Air.	Number of observations.
Exposed Th.	59.5	3.5	3.5	2	71.5.	3.3	7.0	3
On Earth, ..	56.0	1.5	1.5	1	62.5	5.5	5.5	1
On Grass, ..	54.7	8.2	8.5	2	61.0	8.2	11.0	2

The variations of temperature too are all much less in amount, as are those of the state of the atmosphere as to moisture, though the climate is rather damper.

On the subject of terrestrial radiation the paucity of the observation precludes my dwelling. Between 9 P. M. and sunrise the following morning I found the earth to have lost but 6°.5. of heat, whereas a mean of 9 observations at the same hours in the valley below indicates a loss of 12°.

There is as little similarity between the climate of the Kymaons and upper Bengal hills, as between their geology or outline, though so near

in geographical position retaining the same mean level. The differences are analogous to them between the Kymaon and upper Soane valley, and are due to the very different surface soil and means of supporting vegetation.

Though the mean temperature deduced from the few days I spent on this part of the Kymaon is so much above that of the upper Soane valley, which it bounds, I do not suppose that the whole range partakes of this increase. When the alluvium does not cover the rock, as at Rotas and many other places, especially along the southern and eastern ridges of the ghauts, the nights are considerably cooler than on the banks of the Soane; and at Rotas itself, which rises almost perpendicularly from the river, and is exposed to no such radiation of heat from a heated soil as Shahgunge is, I found, the temperature considerably below that of Akbarpore on the Soane, which however is much sheltered by an amphitheatre of rocks.

March 7th.—Left Shahgunge for Mirzapore, following the road to Goorawal, over a dead alluvial flat without a feature to remark. Turning north from that village, the country undulates, exposing the rocky nucleus and presenting the usual concomitant vegetation. Occasionally park-like views occurred, which when diversified by the rocky valleys, resemble much the noble scenery of the forest of Dean on the borders of Wales. The *Mahoowa* especially representing the Oak, with its spreading and often gnarled branches many of the exposed slabs of sandstone are beautifully waved on the surface with the *ripple-mark* impression; of which impression a specimen was picked up at Rotas.

March 8th.—Having encamped at Amoee last night, I proceeded on to Mirzapore, descending a steep ghaut of the Bind hills by an excellent road, to the level plains of the Ganges.

During the few days spent at Mirzapore with my kind friend, C. Hamilton, Esq. I was surprised to find the temperature of the day cooler by nearly 4° than that of the hills above, or of the upper part of the Soane valley, the nights on the other hand were decidedly warmer. The dew point again was even lower in proportion, 7°.6 and the climate consequently drier. The following is an abstract of the observations taken at Mr. Hamilton's house on the banks of the Ganges.

Mirzapur Terrestrial Radiation at Sun-rise.

Air in Shade.	Exposed Th.	Diff.	Exposed on earth.	Diff.	Exposed on grass.	Diff.
60.0	55.0	5.0	..	..	52.0	8.0
62.5	54.5	8.0	56.0	6.5	52.5	10.0
63.0	55.5	7.5	50.5	12.5	50.5	12.5
58.0	53.0	5.0	54.	4.0	50.0	8.0
Mean, 60.8	54.5	6.3	53.5	7.6	51.2	9.6

Mirzapur, March 9th-13th, 1848.

	Temperature.				Wet Bulb.			Elasticity of Vapor.	Dew Point.					Vapor in cubic foot of atmosp.	Saturation.			Number of observations.
	Mean.	Max.	Min.	Range.	Mean.	Max. Diff.	Min. Diff.		Mean.	Max.	Min.	Max. Diff.	Min. Diff.		Mean.	Max.	Min.	
Sun-rise, ..	61.1	63	58	5	48.8	51.5	47.	.236	34.3	30.7	29.7	32.8	23.8	2.574	.405	.450	.327	3
9 A. M....	76.1	83	71	12	58.5	56.5	51.7	.302	41.9	..	..	52.3	15.7	3.271	.394	.603	.176	3
3 P. M....	86.	..	..	..	61.7	24.3	..	.295	41.3	..	..	44.	..	3.089	.264	..	..	1
9 P. M....	76.	..	..	..	63.5	12.5	..	.490	55.2	..	..	20.8	..	5.127	.511	..	..	1

During my passage down the Ganges the rise of the dew point was very steady, the highest means being at the lowest point on the river, Bhaugulpore, which as compared with Mirzapore, showed an increase of 8° in temperature and of 30°.6. in the rise of the dew point. The saturation point at Mirzapore was .331, and at the corresponding hours at Bhaugulpore .742. (Saturation being represented as unity.) The observatious were taken at the house of my friend Dr. Grant.

It is remarkable that nocturnal radiation as registered at sunrise is much more powerful at Mirzapore than on the more exposed Kymaon plateaus; the depression of the thermometer freely exposed being 3° greater; that laid on bare earth 6°, and that on the grass 1°.4 greater on the banks of the Ganges.

A Resultant System for the Construction of Iron Tension Bridges.—*By Major* Henry Goodwyn, *Bengal Engineers.*

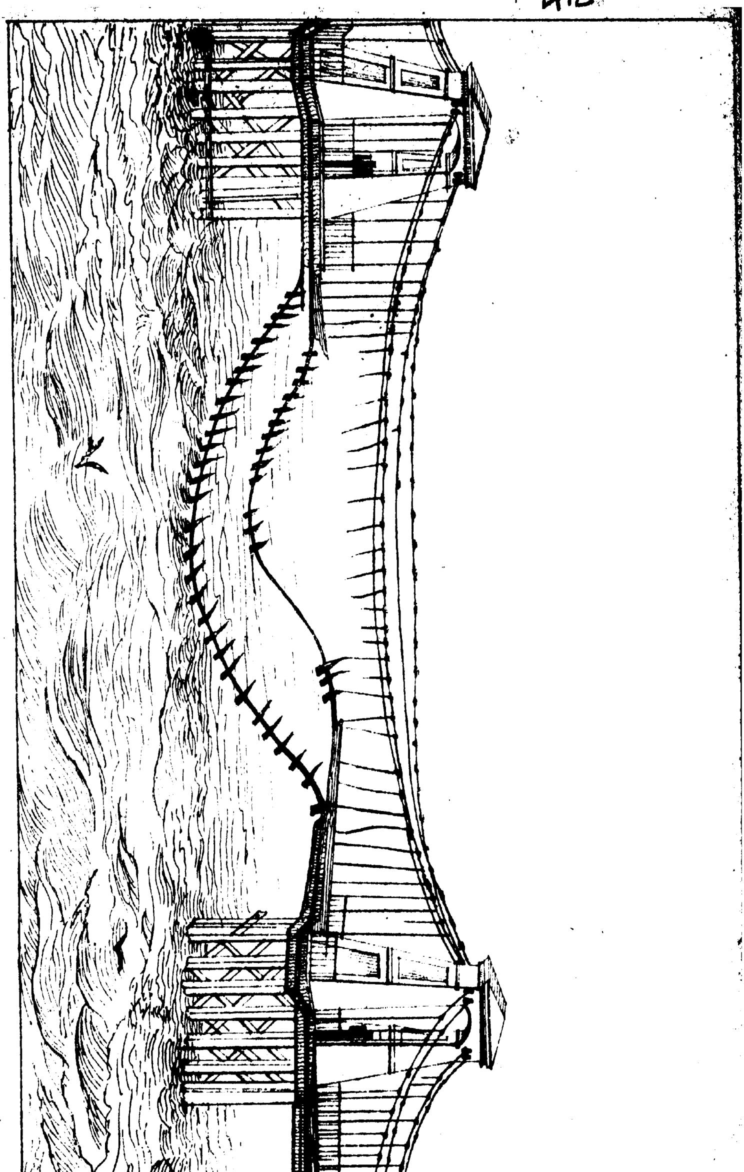
Description of the Frontispiece.

The view of the wreck of the Brighton Chain Pier as here exhibited, is a fac-simile copy of Pl. 90, of the "Theory, Practice, and Architecture of Bridges," published by Mr. Weale in 1843, in which the following brief, yet speaking account is given. The span of each curve is only 255 feet with a deflection of $\frac{1}{18}$th. The damage to the structure occurred in October 1833, when two curves and their platforms were destroyed. The second from the land side had twenty suspending rods carried completely away and many others seriously injured; the third division had 58 suspending rods destroyed. The chains were greatly deranged, and three-fourths of the platform and railing completely destroyed; the two divisions presenting an awful ruin. A rapid undulation was produced in the platform during the storm, and it sank nearly 6 feet on one side, presenting an inclined plane transversely.

It is remarkable, that notwithstanding the violent injury which the storm produced, the Longitudinal Iron bearing bar, with a Sectional area of only 4 square inches, was not broken, though it suffered severe torsion. A bar of the above Section supported the girders of the roadway to which the planks were fastened, and which bars were upheld by the stirrups at the lower ends of the suspending rods.

These remarks are made with reference to paragraphs 3, 4, 5, and 6 of the following Memoir, and the frontispiece itself introduced as an evidence of there being some great defect in the principle of construction which admits of a structure, which has been pronounced one of Sir Samuel Brown's best works, being thus seriously deranged by merely its own weight thus acted on.

The following practical conclusions are chiefly drawn from the demonstrated results of a "Memoir on the quantity of Iron necessary in a Tension Chain Bridge," by the Rev. J. H. Pratt, and published in the CLXXXVI. No. for January 1848, of the Journal of the Asiatic Society of Calcutta, and although a modified Taper Chain system had been drawn out and partially put into practice by me before the appearance of Mr. Pratt's theory, its principles agree so entirely with my



own experience, and its demonstration is so clear, that I have been induced from the wish to promote the advancement of such structures, to place the following exposition of my system on record, feeling sure that unbiassed minds will, on perusal, be divested of the timidity with which the extreme, or Dredge's Taper Chain system has been received, as its errors have been admitted and corrected; whilst, if there be any virtue in the present uniform chain system, the proposed "Resultant" will be found to possess them in an eminent degree, and yet freed from its acknowledged defects.

The fact demonstrated in the above named "Memoir" is simply this, that in all Iron Suspension Bridges of equal span, and breadth of platform, the quantity of Iron in the main parts must be *the same*, and that quantity which "is necessary to enable each part to sustain the greatest tension to which it may be subjected when the roadway is loaded to the greatest extent, is *altogether independent* of the principle of construction or form of the Bridge," provided of course that the principle be sound.

2. This is a very important conclusion, but whilst I freely admit the soundness of the doctrine, I am not fully satisfied as to the correctness of the writer's practical deductions therefrom, viz. that the old system of suspension, consisting of a uniform chain and vertical drop-bars, is the most proper for adoption under all circumstances. For such an opinion the author of the above "Memoir" gives his reasons, which, as might have been expected, are weighty enough, but "*good* reasons must per force give way to better," and notwithstanding what has been advanced above, I think the scale may yet be turned in favor of the opposite opinion, viz. that the old, or uniform chain system is by no means necessarily, and under all circumstances the most desireable for adoption.

3. If the strength or stability of a structure to resist a constant dead weight, were alone the points for consideration, the advantages adduced in favor of the uniform chain system might be conclusive; but wherever failures of Suspension Bridges have occurred, they have in almost every case been caused *not* by a steady, uniform dead strain, exceeding the power of the materials to resist, but by the effect of a much smaller load or weight in a state of motion. *Not*, for instance, during a trial by means of a *proof load* uniformly distributed, but by

the *motion* of a far smaller weight, as of a company of soldiers marching in step, as occurred to the "Broughton" Bridge, near Manchester, nay, the great "Manai" Bridge which was calculated to be equal to a load of 1245 tons in excess of its own weight, and the "Brighton" Chain Pier, (vide Frontispiece and description thereof), to an extra load of 100 tons, have both been nearly destroyed by merely their own weight when put in motion by a violent wind. The large suspension Bridge at "Montrose," which when first put up was proved by a dead weight of 970 tons, being the greatest it would have to bear, was destroyed in a similar manner.

4. The disastrous effects which have already occurred, and may still be apprehended from such causes, to bridges on the uniform chain system, are so universally admitted, that they need not here be further dwelt on; it will suffice to notice that no bridge of large span in any exposed locality, is ever put up without some special arrangement to counteract the vibratory and undulatory, tendencies of the structure. This protection is sometimes attempted by means of guy-chains, sometimes by a system of side and under trussing, (as in the Hammersmith Bridge,) at others by counter chains, (as in the Brighton Pier), the latter being intended to enable the platform to resist the lifting power of the wind from below.

5. From the result of the opinions on the disastrous effects of gales on the Menai Bridge in the years 1826, 1836, and 1839, and especially when during the latter, 148, or one-third nearly, of the suspending rods were torn asunder, no other conclusion can be drawn, than that the tubular rods introduced between the chains, the trussing of the roadway, the small brace chains, &c. did not preserve the bridge from the effects of the combined motions of the vibration, and undulation, of the chains,* which were the primary cause of the injuries sustained, and the reason is evident, viz. that these accessories contended against the effect, without attacking the *cause*. It will be therefore evident, that, something more than strength to resist a known strain in a certain direction, is required, and however true the main position demonstrated by the Rev. Mr. Pratt may be, it still remains an open question whether, in order effectually to meet the varied strains and trials to which Suspen-

* Vide Report by Mr. Provis, resident Engineer. Trans: Civil Engineers, Vol. 3. page 357.

sion Bridges are peculiarly liable, some other arrangement of the *same quantity of Metal,* as is now given to bridges on the uniform chain system, may not with advantage be employed.

6. Here it will not be irrelevant to observe that all the expedients had recourse to, for the purpose of counteracting the vibration and undulation of the uniform chain bridges, not only, of course, increase the expense, and weight of the structure, but absolutely negative the principal advantage expected from, and claimed for, that system, (viz. the simplicity and directness of the strains,) in the ratio of their attaining the object for which they were added, i. e. the stiffness of the whole.

7. Before proceeding to show, and I trust to prove, what will be a more advantageous disposition of a given weight of metal in a bridge of known size and proportions, than that which would be attained by the uniform chain principle, it will be necessary to notice a mode of construction for which a patent has been obtained by Mr. Dredge, who proposes to erect bridges of equal, or even greater strength, than those on the uniform principle, with about ⅓d of the quantity of iron usually employed in the latter; but as the practicability of such a result is wholly at variance with the demonstration proved by the calculations of the Rev. Mr. Pratt, now under reference, and as no one has yet impugned the correctness of the formulæ on which the strength of the uniform chain system is calculated, it is scarcely necessary to do more than base the rejection of Mr. Dredge's extreme taper chain system on the grounds of its non-conformity with the rules quoted above; unfortunately however, the Ballee Khâl Bridge near Calcutta, originally constructed in strict accordance with this principle, which fell by its own weight, and the inability of the "Kubudduk" Bridge near Jessore in Bengal, to withstand the ordinary proof trial, together with its subsequent failure, sufficiently confirm the accuracy of Mr. Pratt's conclusions. The iron work of the latter bridge was constructed by Mr. Dredge himself.

8. In the beginning of this "Paper" I remarked that I had practically, i. e. experimentally corroborated the fact demonstrated in Mr. Pratt's Memoir* and the failure of the Ballee Khâl Bridge led to so much study and research into the principles which should govern a

* Vide account of "Experiments" at the end of this Memoir.

Taper Chain Bridge, that the result has been an encouragement to combine the Taper Chain with the uniform system, possessing in conjunction the advantages of each, with the positive defects of neither, and which I will presently explain, after glancing at the evils which are acknowledged to exist in both the above principles.

9. The most important fact gleaned from the above experience and research is one entirely overlooked by Mr. Dredge, viz. that where *strength* or *section of Iron* is taken away from the chains, it should be made good in the *Longitudinal Beams* to which they are connected. Not that the precise quantity abstracted from the former should be added to the latter, but that additional strength should be given to the beams bearing a certain ratio to that taken from the chain. Mr. Dredge, and the uniform chain system, afford instances of opposite extreme cases. In the former, the section of the outer longitudinal beams at the centre, where the chains are a minimum, should be nearly equal to the entire section of the chains at the point of suspension, the portion of beam in the centre of the bridge standing in place of the chain theoretically, and almost so *in practice;* in fact the longitudinal beam is an indispensable item in the Dredgeian combination, whereas in the uniform system the reverse is the case, for by the non-diminution of the chain in the centre, there is no absolute necessity for the longitudinal beam as a component portion of construction.

10. The principal defects of Mr. Dredge's extreme Taper system are,

1st. The hazard of trusting a bridge, whatever the span may be, to the strength of *one,* or even *two* rods at the centre, for (admitting for the sake of argument, that the section there may not be disproportioned to the strain) yet the fracture of the link in the centre, (and being so slender there is the greater probability of such an event there than elsewhere) would be attended with very dangerous results; the conclusion therefore to be drawn from the admitted inexpediency of confiding in the strength of so small a section of iron in the very centre of the bridge is, that the chain should not diminish so rapidly as, in the extreme Taper system, it does.

11. 2ndly. As noticed above, the section of iron in the longitudinal beams is uniformly weak throughout with reference to the tension at the centre, which, where the beam comes in place of the chain, is infinitely great, as compared with that exerted near the standards.

12. Here, as regards the second defect, it may be objected, that Mr. Dredge never intended his bridges to be sustained by tension in the longitudinal beams at any point of their length, assuming in his theory that "the tension at the centre is a cypher." The capacity of the platform to resist *compression* in the two half curves, and not the power against *tension*, being brought into action.

13. Such has been Mr. Dredge's view and his rule of construction, but experience on a full sized scale, (independent of the failure of the bridges above noticed) has satisfied me that there is not strength in the combination of the platform to resist compressive power. The defect was proved as follows :—

14. The whole of the iron work of a complete half curve of a bridge of 120 feet span and 16 feet width of platform, was put up in the Government Iron bridge yard on standards erected of masonry for the purpose, thus : (See Fig. 1.)

The centre link was carried out horizontally in its proper position, and attached to a wooden beam abutting against two trees. The central ends of the longitudinal beams were left free, as shown above, the other ends being built firmly into the masonry in their cast iron boxes, whilst the half platform rested on three posts on each side, to preserve the horizontality till the whole was put up. Every thing being in position, the transverse beams, railing, &c. fixed, it is evident that on the removal of the posts the structure would not fail, if there was sufficient stiffness in the combination of the framing, to resist the compressive action by the combined oblique pull of the auxiliary rods depending from the chain; accordingly the posts were one by one removed, when it was immediately seen that there was not that degree of stiffness in the framing to resist the amount of compression from the centre towards the standards, for when all the posts were removed, about one-third of the length of the platform from the standards was bowed out 25 inches, as in the annexed figure. (See Fig. 2.)

There was at this time no extra load on the platform, and the conclusion seems obvious, that unless the longitudinal beams be kept straight by tension from the opposite half curve, the framing could hardly bear its own weight, far less be equal to a traffic load of 112lbs. per square foot. In other words, the combination and scantling assigned by Mr. Dredge have not strength to resist the compression ; the stability

therefore of the structure must depend on the capability of the longitudinal beams to resist tension.

Mr. Dredge has in fact carried the principle too far, and has concluded that, because the lowest point of a chain is that of least tension, such an arrangement may be effected by which there shall be none at all. He has also assumed perfect rigidity for his platform, which is composed of a flexible combination, and which, if in the slightest degree displaced, causes collapsion of the whole.

15. The third defect in the extreme Taper chain system is the great obliquity of the central auxiliaries, and the great difference in the angles of obliquity; varying from 10° at the centre to about 65° at the standards; the strains to which they are exposed by equal weights are consequently very unequal.* This conclusion hardly requires elucidation, but the subjoined diagram (Fig. 3.) drawn to a scale, and on the principle that, when three forces are in equilibrio the strains in each direction are proportional to the sides of a triangle in the direction of the forces, shows the actual tension on the central oblique rod, and in that nearest the standard, of a bridge constructed strictly on Mr. Dredge's system, the angles of attachment being 59° 19′ at the standards, and 9° 30′ at the centre. (See Fig. 3) or as in Fig. 4, the weight being in both cases expressed by unity. (See Fig. 4).

The tension on the first oblique rod from the pier will be 1.18 and the horizontal tension 0.6, whilst that on the central oblique rod will be 6.14, and on the horizontal line 6.05, so that equal sections of iron are strained in the proportion of 6 to 1.

16. The advantages of the above system are, first, that a considerable portion of the platform is supported by rods direct from the standards, thus leaving a diminished tension due to the chain, and secondly, by the oblique action of the auxiliary rods the system is retained under the dominion of a certain amount of Tension, rendering the roadway free from the injurious effects of undulation and vibration, and making the transit more firm and pleasant.

17. The defects of the Uniform chain system are,

1st. The whole weight of the bridge is supported by the chains, rendering them very heavy, massive and costly, as also more susceptible of receiving the impulse, which in storms is the primary cause of the destructive motion given to the roadway.

Fig. 1.

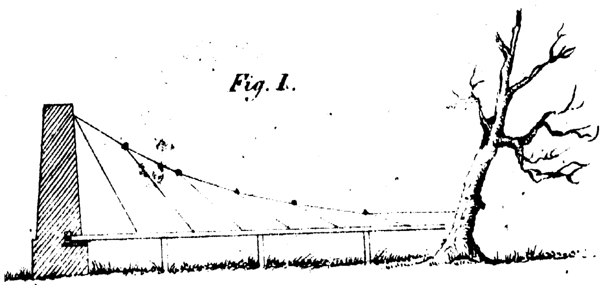


Fig. 2.

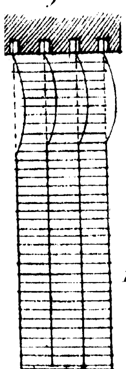


Fig. 3.

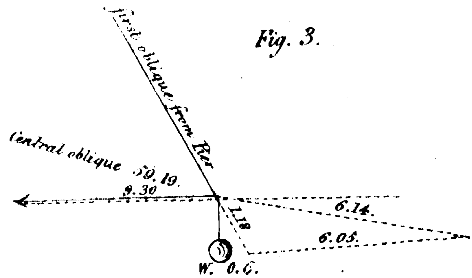


Fig. 4.

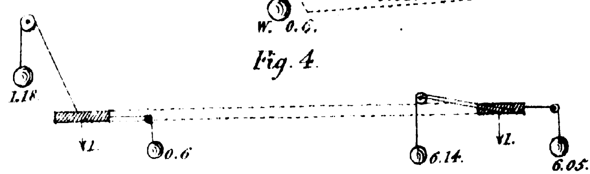


Fig. 5.

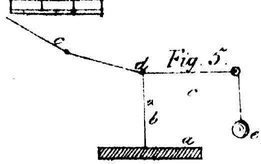


Fig. 6.

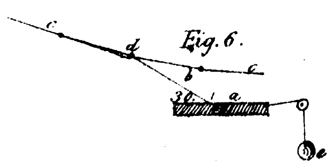


Fig. 7.

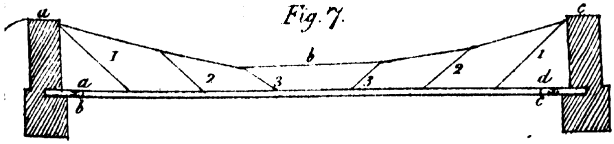
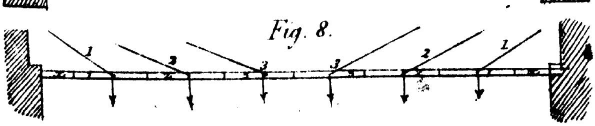


Fig. 8.



18. 2ndly. The platform being wholly supported by the action of gravity, the equilibrium of the system is disturbed by the most trivial causes, the transit even of a single foot passenger over a bridge of 200 feet span produces a sensible vibration, whilst the motion of heavy bodies is attended by effects actually injurious to the structure, and it may therefore be readily conceded, that the effects of storms is very much to be dreaded, of which the Menai, the Brighton Pier and Montrose bridges are instances.

19. Few, if any suspension bridges on the uniform system are constructed on any very close calculations of the strength of the different parts; generally a very wide margin is allowed over and above the power required by calculation; thus the Menai bridge is equal to a permanent load of nearly 400 tons above the weight of suspended roadway, added to a full load of 75 lbs. per square foot; and the bridge at Montrose is equal to nearly 100 tons in excess of the entire load to which it can be subjected, yet notwithstanding this excess of strength in actual section of iron in the chains, these bridges have been in imminent danger of total destruction when *unloaded*, from what may safely be called the defects of construction; surely nothing need be added to show the inexpediency of providing a vast excess of strength in any structure to meet a dead weight which it can never be subjected to, and at the same time leave it unprotected to encounter the danger of disruption to which at any hour it may be exposed from natural causes?

The lately constructed bridge at Hungerford Market over the Thames, 676 feet span, has a sectional area of 312 square inches, and as the actual tension on the chains, even with the enormous assumed weight of 170 lbs. per square foot of platform, could not exceed 1420 tons which @ 9 tons per square inch, requires 156 square inches, there is exactly double the section or strength necessary for the structure.

Resultant System.

20. I will now proceed to explain a system which only proposes to do what the formulæ in Mr. Pratt's Memoir says may be done, which is based on the experience and research I have above noticed, and which proves what it engages to do, in a manner, I trust, unexceptionable. For,

already have the Ballee Khâl bridge, the Kubudduk bridge, and five other bridges of spans varying from 200 feet to 120, which were originally constructed on the extreme Taper chain principle, been (as far as was practicable) remodelled on the system I am about to advert to, and most of which have now been erected 3 years, fully proved by previous loading, and subjected to very heavy traffic and storms. It is merely a different application of the uniform chain system, though it partakes of both that and the Taper chain; I term it "The Resultant," indicating thereby that the chains by construction, are in absolute strength, and in the direction of their links, "Resultants" of the tensions due to the adjoining link and auxiliary depending therefrom. It is in fact emphatically a system of equilibrium. The chief differences between it and the old system consist in a modified reduction of the section of iron in the chains from standard to centre, with a corresponding increase in the horizontal power in the opposite direction; in fact, transfering in part the horizontal tension, which, together with the oblique, is borne by the chain in the uniform system, to the line of the platform by means of the deviation of the suspending rods from the perpendicular.

21. In the uniform chain system, as is well known, the suspending rods are vertical. In the "Resultant," they are set at an angle with the roadway, and in proportion to the deviation of this angle from the vertical line, a new element is brought into operation, viz. tension in the horizontal line. This does not affect the principle of construction, but only renders necessary a new distribution of the forces required to support the structure; this will be evident from the consideration of annexed diagram (Fig. 5.) which represents the principle of the uniform chain, in which the oblique and horizontal tensions are borne by the chain alone, and as these are nearly equal, the power or section of the chain in either direction from point D must be equal also. (See Fig. 5).

Here the weight of the portion of platform A to be supported is sustained by a single force B, from the main chain C. C. If therefore A=8 tons, the rod B must be equal to that strain. Fig. 6, is an example of the "Resultant" principle, in which the portion (See Fig. 6) of platform weighing, as before, 8 tons, is supported by two forces, viz. the oblique rod B, in the direction b D. and the horizontal force E. Supposing the angle at b to be 30° the rod B. will be strain-

ed with a power of (the weight $\times$ by cosecant of the angle b)$=16$ tons, whilst the horizontal force or (weight $\times$ cotangent of the angle b)$=14$ tons.

Now although in the first instance the actual tension on the rod B is only 8 tons, and by that the weight is upheld, whilst in the second the total amount of sustaining power is $16+14=30$ tons, yet mark the difference of effect on the chains from which such rods are suspended. In a bridge of 160 feet span and 20 feet width of platform (for example) the area to be supported will be 3200 square feet, which, at 120lbs. per square foot will be 172 tons. With an angle of suspension of 15° the tension on the chain in the uniform system will be $\frac{1}{2}$ weight $\times$ by cosecant of the angle of suspension, or $\frac{172}{2} \times 3.86 = 332$ tons.

In the "Resultant" system (vide Fig. 17, in which the entire series of strains have been worked out as shown in the table) the extreme tension on the chain, or that due to the upper link, is 192.82 tons, the difference being made up in the tension on the horizontal beam, for which a proportionate section of iron is allowed, and this horizontal beam is not an extra item introduced merely to meet the strain, but is a component part of the system of framing of the platform, and as necessary to the whole as the platform of any ordinary suspension bridge.

Here then it is apparent that, in Fig. 5, the weight supported vertically causes a tension of 332 tons on the upper link of the example above mentioned, and that a proportional section of iron must be given to meet that strain, and not only that, but the same section must be continued throughout the whole series of links; whereas, as in Fig. 6, the extreme tension on the chain, with an equal load, is only 192.82 tons, so that its section can be reduced in the proportion of 1 to 1.72 in the upper link, each link in the descending curve becoming lighter in proportion to the extent of diminution allowed; in addition to which advantages the chain links, by the oblique position given to the suspending rods, are strained in the direction of their length, the most favorable to which they can be exposed. Finally if the weight of the whole series of chains, links, and vertical rods in the old system, be compared with the chains, oblique rods, and longitudinal beams of the "Resultant" system, for any given bridge, it would be seen that the two correspond as nearly as can be obtained in practice. This I have

proved beyond doubt from the result of those bridges enumerated in the 20th paragraph, as remodelled on the " Resultant" system.

22. I will now detail the theory on which the "Resultant" principle is based.

In Fig. 7, A B C represents the chain of a tension bridge, the centre link of which is above the level of the railing; a b c d, the roadway, or suspended platform, (See Fig. 7,) the small portions x x being supported by the abutments. Let 1, 2, 3; 3, 2, 1, be the auxiliary oblique rods from the chain, the angle of those at the centre not being less than 25° and those next the standards not greater than 45°. It is evident that the platform is entirely upheld by the auxiliaries, and it is to them therefore that our attention is first directed.

23. The auxiliary rods being by construction attached at equal distances, it is intended that each set shall bear an equal duty or tension, and as the stiffness of the platform to resist the force of gravity is uniform throughout, the whole series of oblique rods benefit equally thereby, and being thus common to all, it may be omitted in considering the strains on the auxiliary rods. (See Fig. 8).

Suppose the platform to be divided into as many equal parts as there are oblique rods, thus giving to each rod an equal load, the points of attachment of which being the centres of gravity, we have six rods, 1, 2, 3, 3, 2, 1, supporting the equal portions of platform having corresponding numbers.

24. The several portions of the platform acting by gravity whilst the sustaining force is oblique, a third force is necessary to preserve the whole in equilibrio. This force is, in the present system, tension in the horizontal line as shown in annexed Fig. 9, and acting from the standard towards the centre. These three forces, viz. vertical, oblique, and horizontal, being in proportion to the radius, cosecant, and cotangent of the angle of obliquity; the tensile force being that under consideration, it is necessary to connect the portions of the platform in Fig. 8, in such a manner that the weight or force of gravity shall act freely, whilst the several parts are prevented from separating. Fig. 10, will show the meaning.

Here we have the tensions on the several portions 1, 2, 3, on one side, or half span, counterbalanced by an equal amount of tension on the portions 3, 2, 1, of the opposite half, hence the greatest strain is in

the centre, which has the pull of 3+2+1 acting on it; the connecting link between 2 and 3, being strained with the tension of 2+1, and that between the parts 1 and 2, with the strain due to the part 1 only. Now the outer longitudinal beams of the system stand in the place of the connecting links of the above Fig. 10, and are exposed to the varying tensile forces as described along the whole length, the amount of each of which admits of easy calculation, and whilst the precise spot of the greatest effect can be exhibited, the exact amount in every portion of the system can be accurately ascertained, and consequently provided for.

25. The following Figs. 11 and 12, will show the relative tensions in the oblique and horizontal directions, in both Mr. Dredge's and the present "Resultant" systems. Fig. 11, showing the strains where the oblique rod angles vary, as practised by Mr. Dredge from 10° to 60°, and Fig. 12, the strains where the variation of the angles is only from 25° to 45°. (See Figs. 11 and 12).

The force of gravity being represented by unity in both cases the extreme difference in the amount of tension in the oblique rods of Mr. Dredge's combination is as 5 to 1, and in the horizontal beam as 10 to 1, (Fig. 11.) whilst in the "Resultant" system under adoption, as shown in (Fig. 12.) the variation of tensions in either direction between the centre and standard is as 1.4 to 2.2 greatly to the advantage of the latter.

26. Now to apply the same principle of the composition of forces to the chain, so that the system may be in equilibrio. The span, width of roadway, its construction, the spaces between the oblique rods, and angle of the central one being determined, the weight to be assigned to each set of auxiliaries may be safely assumed at 120 lbs. per square foot of platform, including the weight of the structure.

27. The tension on the centre, or horizontal link may be arbitrarily assumed, i. e., it may be made any proportion of the link at the point of suspension, thus tapering the chain $\frac{1}{3}$d, $\frac{1}{4}$th or $\frac{1}{5}$th, part of the sectional area of the upper link, for it is evident that by the arrangement of the angles formed by the first link from the centre and first set of oblique rods, the strain on the centre link may be =0, or =1000 tons, as is shown in annexed Figs. 13 and 14, where it is clear (Fig. 13.) that the tension on the centre link c. b. is increased or diminished as the line c. e. (the prolongation of a. c.) approaches nearer to c. b. or c. d.;

the tension on c. b. will be a maximum when a. c. b. are in one line, and a minimum (Fig. 14.) when a. c. d. are in one line. The minimum of the central angle has however been practically determined to be 25°, with a view to the equilization, as far as practicable, of the strains on the entire series of oblique rods.

28. We have thus the means of assigning to the centre link any amount of power; its direction, (horizontal) is known as well as the tension and direction of the central oblique rods, we have therefore two forces, the magnitude and direction of which, with reference to each other, are known, from which to obtain a resultant, which shall be the first link from the centre. And here it must be borne in mind, that the height of the point of suspension and consequently deflection of the chain depend on the power of the centre link, for the resultant, or first link from the centre will form a greater or less angle with the horizon as its direction approaches less or more to that of the centre link, and the resultants arising therefrom, as the series of the chain draws nearer to the standards, will all be similarly affected.

29. The first resultant from the centre link and oblique rod is obtained from the following expression, (Fig. 15.)

Suppose given A B=200	centre link.	The actual forces in the bridge designed for the "Jumna" at Agra.
A C= 33	centre oblique rod..	
∠ A C E or C A B= 25°	....	

to find the magnitude and direction of A. D.

By Trigonometry,

$$A\,D^2 = A\,C^2 + A\,B^2 - 2\,A\,C.\,A\,B.\ \text{Cos} : A\,B\,D$$
$$= A\,C^2 + A\,B^2 + 2\,(A\,C.\,A\,B\ \text{Cos} : A\,B)$$
$$= 1089 + 40000 + (13200 + 906)$$
$$A\,D = \sqrt{53048} = 230.32 = \text{magnitude of } A\,D.$$

Again,

$$A\,D : \text{sin. } B\,A\,C : : \begin{Bmatrix} C\,D \\ A\,B \end{Bmatrix} : \text{sin. } C\,A\,D.$$

Sin. B A C=25°	.... log.	9· 625948
A B=200	....	2· 301030
		11· 926978
A D=230·32	....	2· 362332
Angle C A D=21°.32′	....	9· 564646

Fig. 9.

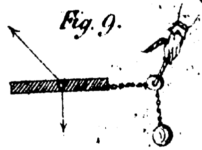


Fig. 10.

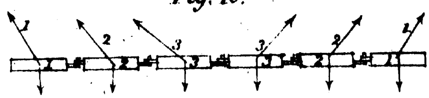


Fig. 11.

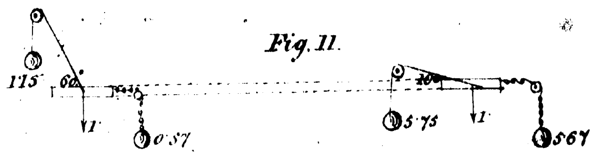


Fig 12

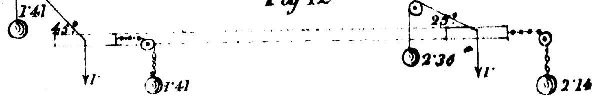


Fig. 13.

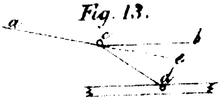


Fig. 14.

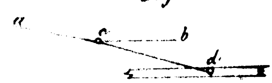


Fig. 15.

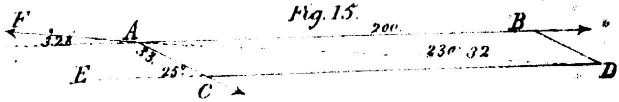


Fig. 16.

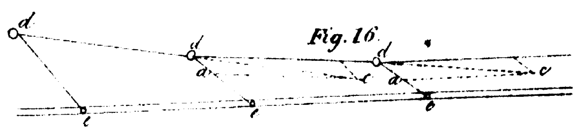


Fig. 19.

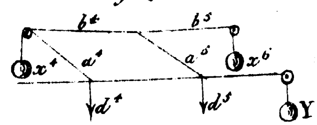
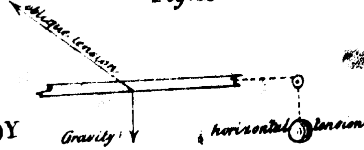


Fig. 18.



And angle C A B—angle C A D=25°—21°·32′=3°.28, or angle of first resultant A F with the horizon. Thus the magnitude and direction of the first link are found, and the link is a true resultant of the two forces acting at its lower extremity. In like manner can each link be ascertained till the series is complete, and thus a perfect system of links and auxiliaries will be obtained in equilibrio, under the maximum strain to which the structure can be exposed.

30. By reference to annexed Fig. 16, the formation of the chain will be readily understood from the mechanical construction, as, shown in the dotted lines, which are the forces taken from a scale of equal parts, and correspond with the results obtained by the mode of calculation above referred to. (See Fig. 16.)

The points of attachment, e, e, e, of the oblique rods and platform, are originally known, the span being divided into a number of equal parts; the length of the links or points d. d. d. are found by the annexed formulæ (Drewry, p. 172).

$\sqrt{\left(\text{deflection} + \frac{\text{deflection}}{3}\right)^2 + \text{semichord}^2} =$ semilength of chain, which must be computed independent of the centre link. The semi-length thus obtained is to be divided into as many links as are required, which will of course depend on the number of spaces of the platform upheld direct from the standards (Fig. 17). The deflection may be assumed any proportion of the chord line from a 10th to a 15th. In small bridges the latter is the best as affording greater rigidity, with but little extra material; in large spans, perhaps a medium, or $\frac{1}{12}$th will be found most practicable. In the above Fig. 16, a c, a c, represent the strains on the main chains, a d, a d, the tensions on the oblique rods, and c d, c d, the resultants.

31. In a bridge on the resultant system of 500 feet span and 24 feet width of roadway, if the chain were made to taper at the centre to $\frac{1}{3}$th the section of the link at the point of suspension, which in this case would be equivalent to the tension of 1014 tons, the central link would have 9 times the strength, that in the extreme, or Dredge's tapering system, would have been assigned to it, whilst from the position of the resultant link, and collateral oblique rods, the iron in the centre, does not hang as dead weight tending to produce vibration by the slightest cause, as in the uniform system, but is kept under the dominion of tension drawn in the direction of its length, and thus preserved steady and rigid.

32. In paragraphs 24, 25, the principle that is to guide the construction of the longitudinal beams has been given, viz. as the third force acting by tension horizontally to preserve the equilibrium with the oblique force and that of gravity; and in paragraph 9, full explanation of the reason of the above arrangement has been entered into, and it has also been shown that provision can be made to meet the several amounts of tension acting on the beam in the horizontal line. If this were all that the longitudinal beam had to perform, a construction similar to Fig. 10, would answer the purpose, and the section of the different portions might diminish from the centre, towards the standards in proportion to the variation of the strains produced by the auxiliaries, but as these beams are intended to bear the vertical weight of the platform together with the heavy traffic load, and other contingencies, a compact or uniform section should be retained in bridges of small span equal to that demanded at the centre, which will be the most advantageous to the system, and facilitate the actual construction, though in larger spans a considerable reduction of section may be effected between the centre and standards.

33. The "Resultant" system as above elucidated, cannot surely fail to present many valuable points for recommendation, professing, as it does, practically to coincide with the theoretical and analytical conclusions of the author of the "Memoir" under notice, and moreover, whilst it is divested of the positive defects of both the systems which have been simultaneously reviewed, a powerful resultant is obtained from the composition of the advantages or forces of each of them. This system has been somewhat hastily "damned with faint praise," by some, because they would not take the trouble to ascertain its principles of construction; it has been passed over by others, from absolute inability to understand them, simple as they are, but from what has been shown above it will be clear that, with the condemnation of the "Resultant" system, the uniform must be included, the latter being nothing more than an extreme case of the general system in which the strain on the chain is a maximum, and the horizontal tension is 0, whilst the system of Mr. Dredge in a way aims at, (but does not attain,) the opposite extreme, where the tension on the chain is a minimum, and that on the horizontal line a maximum.

34. It now remains to show another advantage of the "Resultant" system with a diminishing chain. The annexed Fig. 17, is the con-

structed resultant curve of a bridge of 160 feet span as designed, with the several forces and angles delineated, and the subjoined table shows the forces from which each link has been obtained, their magnitude and direction; it will be obvious that the horizontal tension of each portion of platform supported by an oblique rod will be communicated through the medium of the side longitudinal beams from the standard to the centre, so that the tension on one half the bridge is counteracted by that on the opposite half; this amount of tension in a loaded bridge of large span is very great, (600 tons in a span of 500 feet, and 24 feet wide) being the sum of all the horizontal tensions A+B+C+D+E, &c., and as the ends of these side beams are securely built into the standard masonry, the swaying of the structure from side to side, or undulation vertically under the influences of storms, or other ordinary destructive causes, (excepting to a very slight extent) is prevented. At the proof trial of the Ballee Khâl bridge, 250 feet span, after its reconstruction on the Resultant principle, the transit of a large elephant, and 24 pounder siege gun (See Fig. 17. also Table next page) with all its appurtenances, caused no sensible vibration, or visible depression, whilst at the conclusion of the ceremony the entire platform was covered with a dense crowd of villagers, who, on the departure of the Governor and suite came to witness the opening, and congregated as far as they were able to one side of the bridge, thus giving fair proof of the stability and rigidity of the structure.

35. If therefore, as demonstrated by the Rev. Mr. Pratt, the quantity of iron calculated to resist a certain dead weight, be the same for bridges of equal span and width, and of equal strength, whether the metal be distributed, as in the uniform system, or as in the "Resultant," it surely is no small advantage in favour of the latter, that, by construction, it is defended from the severe trials to which all bridges, even when unloaded, are exposed, from the momentum which a comparatively light body obtains when put in motion.

36. The extra aid usually applied to suspension bridges on the uniform system for the purpose of stiffening them, has been found absolutely necessary, and duly commented on in paragraphs four and five, and whilst such means are almost indispensable in the old system, to compensate for vicious construction; in the resultant system they form an essential part of the principle; and considering the results of the experiments on a full-sized scale, (vide end of this memoir) the

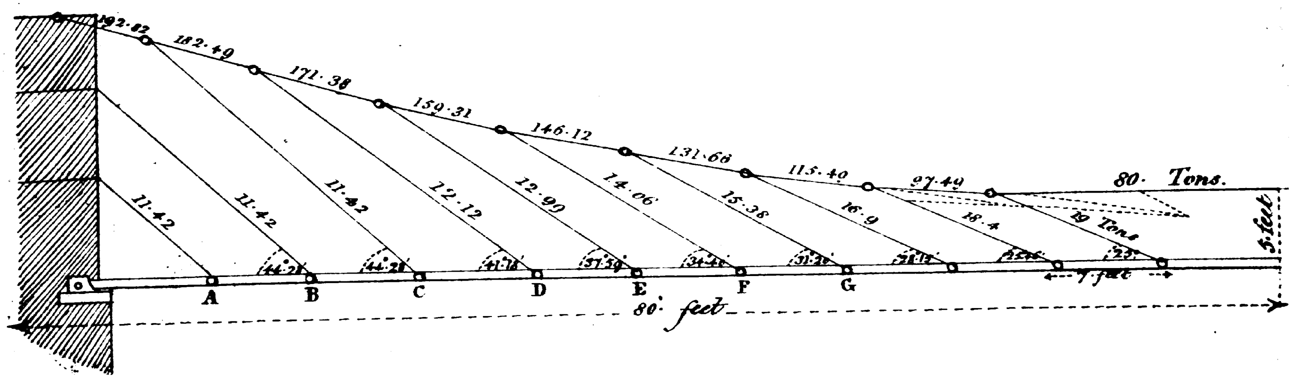
favourable reports on those bridges actually constructed on the resultant principle, together with the theoretical soundness of the details, it appears neither reasonable or consistent to object to it since it has every good quality that such a structure can require, to recommend it.

Table Showing the Forces of Links and oblique Rods, with the Resultants obtained therefrom.

See Fig. 17.

Forces composing the Resultants or Link of chain.	*Forces due to chain.*	*Angles of oblique rods with horizon.*	*Cosecants of angles of oblique rods.*	*Angles of oblique rods with chain.*	*Weight of one space of platform.*	*Angles of chain links with horizon.*	*Cal. Resultants or Tension on chain links.*	*Position of Link.*
	Tons.							
Centre link,	80	....	....	....	....	....	....	Centre link.
Centre oblique rods, ..	19	25°.	2·366	25°	8 Tons.	5°.45′	97·49	1st link from centre.
1st link from centre, ..	97.49							
2nd set of oblique rods,	18.4	25°.46′	2·3	20°.1′	,,	8°.58′	115·49	2nd link from centre.
2nd link from centre, ..	115.49							
3rd set of oblique rods,	16.9	28°.15′	2·113	19°.17′	,,	11°.24′	131·66	3rd link—ditto.
3rd link from centre, ..	131.66							
4th set of oblique rods,	15.38	31°.20′	1·923	19°.56′	,,	13°.27′	146·12	4th link—ditto.
4th link from centre, ..	146.12							
5th set of oblique rods,	14.06	34°.46′	1·758	21°.13′	,,	15°.17′	159.31	5th link—ditto.
5th link from centre, ..	159.31							
6th set of oblique rods,	12.99	37°.59′	1·624	22°.42′	,,	16°.57′	171·38	6th link—ditto.
6th link from centre, ..	171.38							
7th set of oblique rods,	12.12	41°.18′	1·515	24°.21′	,,	18°.31′	182·49	7th link—ditto.
7th link from centre, ..	182.49							
8th set of oblique rods,	11.42	44°.28′	1·427	25°.57′	,,	20°.	192·82	8th link—ditto, or upper link of chain.

Fig. 17.


192·82
182·49
171·38
159·31
146·12
131·66
115·40
97·49
80· Tons.
11·42
11·42
11·42
12·12
12·90
14·06
15·38
16·9
18·4
19 Tons
44·21
44·21
41·76
37·59
34·46
31·20
28·14
25·46
23
A
B
C
D
E
F
G
7 feet
5 feet
80· feet

Results of a series of experiments instituted for the purpose of testing the newly proposed Resultant Taper Chain principles.

Pl. XXIV. Fig. 1, is illustrative of the first experiment, which was intended to test the theory of a system based on the "resolution of forces," as explanatory of the proposed construction of the Agra bridge.

The idea of compression in the horizontal line having, from actual proof, been deemed untenable in bridges of any ordinary span, the opposite power of tension has been admitted as the third in the series to produce an equilibrium jointly with those of gravity, and the tension in the oblique direction from chain to platform, thus: (See Fig. 18). The oblique and horizontal force in a series bearing theoretically a certain proportion to each other with reference to the obliquity of the former, the weights at each point being uniform; this experiment was instituted to prove practically how far that theory was correct.

It was also intended to illustrate practically the theory relative to the position and power of the chains, the links of which are calculated to be true resultants from the two forces immediately below them in the chain, viz. the link and oblique rod attached to the lower extremity of that resultant.

Fig. 1, shows the experiment which was to prove whether, individually or collectively, the several sets (three forces applied to any point to produce equilibrium) of forces which may be applied to any single rod, link, or the entire series of rods and links, will be proportionate to the different strains, which are those calculated as due to the parts of a bridge of 100 feet span, 16 feet wide, constructed on the above principle.

The experiment was on full scale as regards heights and distances, but formed of material $\frac{1}{225}$th of the strength of the real bridge, the uniform weights at the points of junction of the oblique rods with the platform being in the same proportion, allowing 120 lbs. per square foot.

The point of suspension is 2 feet from the centre of the standard, making the half span of the chain 48 feet.

The power of the centre link, by actual construction, was made equal to $\frac{1}{4}$th that of the upper link, or whole amount of tension which would be due to a uniform chain, and the angle of the central oblique rod determined to be 30°., the deflection being $\frac{1}{11}$th.

The chain was not at first attached, but the forces necessary to preserve equilibrium at the points of attachment of the oblique rods with the platform, first attended to, as follows, each of the portions of platform (c, c^1, c^2, &c.) being separate at first, and afterwards flexibly connected.

To the portion (c) with a weight (d) of 56 lbs. was attached a single rod (a) passing over a pulley at point of suspension; a weight (x), and part of weight (Y) passing over a pulley in a horizontal line, were added in such proportions till they produced an equilibrium, i. e. till the portion of platform (c) was made horizontal by the joint effects of the two weights x and Y.

The subjoined table shows in its several columns what the proportions of the weights (x, x^1, x^2, &c., and Y) should be, theoretically calculated, to produce equilibrium at the different points as the rods were successively attached; and it also shows what the actual weights were particularly applied in succession, as well as the collective results on the whole series, with the differences.

At the distance of 7 feet the oblique rod (a^1) was attached to a second piece of platform (c^1), with its weight of 56 lbs., which latter was also connected to the piece (c) flexibly; the weight (x^1) appended to the rod (a^1) and weight (Y), increased till the equilibrium was produced, or both pieces of platform (c, c^1) were in a horizontal line. In like manner were all the obliques (a^2, a^3, a^4, a^5,) attached to the several portions (c^2, c^3, &c.) of platform, and the weights added and corrected: when the whole series was complete, the weight Y had attained its maximum. The table will show the differences between the actual weights (Y, Z, x^1, x^2, &c.) and the numbers on the plate, which are those mathematically calculated as due to the several rods and beam.

The result shows that the whole were increased slightly beyond the calculated amounts; but this may be attributed to the friction of the chains upholding the oblique rods, which passed over cast iron pulleys 9″ diameter. It will be observed, however, that the increase was proportional: thus the originally calculated weight (x^1) due to the oblique rod (a^1) was 74 lbs., but, to produce equilibrium, required to be increased to 95, and the calculated total amount of Y was 406 lbs., afterwards practically requiring 519; but the numbers 74 and 406, are relatively proportional, to 95 and 519.

To prove the proportions due to the chain links in connection with the rest of the parts, the oblique rods were severally disengaged from the pulleys, and attached to the chain as follows. The rod (a^6) was first attached to the centre link (b^5), the outer end of which was fixed to a chain passing over a pulley, and to which was appended weight x^6. The lower end of the link (b^4) was likewise attached to the junction of the two rods, and its upper end to a chain passing over a pulley with weight x^4 appended, the intermediate pulley and weight x^5 being removed. In this position was remarked the amount of the weights required to produce equilibrium, and what proportion x^4, which denoted the tension on link b^4, bore to the numbers mathematically calculated: the result of the whole is shown in the table, and the annexed Sketch, the position of the rods at this period: (See Fig. 19) (b^4), being a true resultant of b^5 and a^5. Each other link (b^3, b^2, &c.) was then added in succession, the weights (x^4, x^5, &c.) being withdrawn in turn, and that attached to the link under investigation being increased as the experiment approached the upper link (b), when the weight Z denoted the total tension on the upper link.

Thus was shown the separate tension on the oblique rods, the horizontal tension on longitudinal beam, and the tension on each link of the chain: the results, as compared with theory, are noted in the table, and are satisfactorily approximate to each other.

It was stated in the report of the Committee on the Ballee Khâl bridge, and referred to in the ninth paragraph of my statement on the resultant system, before alluded to, that the power of the longitudinal beam at the centre, added to the power of the centre link should, together, be nearly equal to the power of the upper link, so that whatever power was taken from the chains in the centre, should be compensated for in the longitudinal beam. Now the result of the experiment entirely coincides with that opinion, and confirms the view taken of this part of the construction. The total corrected amount of weight Z was 1086 lbs., and the sum of weights x^6 and Y, or $572+519=1091$ lbs.

Experiment the second, Fig. 2, was proposed by Colonel Forbes, on Mr. Dredge's extreme oblique principle, with the sole exception that the central portion of the roadway beam formed the horizontal connection between the first slanting links on each side of the centre, thus, in the Fig. 2, as before, c, c^1, c^2, &c., denote the platform, b, b^1, b^2, the

chain, the lower link of which is attached near the centre to the longitudinal beam at c^8. In this position only can Mr. Dredge's theory of a vanishing strain existing in the centre link (N, dotted line) be granted; but at the same time the roadway beam must be equal (nearly) to the full section of iron in the upper link, as the result proved. The weights Z and Y were alone necessary for this experiment, the weights a, d, d', d^2, d^3, being, as before, ½ cwt. each.

The span of this half curve was only 40 feet, yet it required 1242 lbs. at Y, and 1302 lbs. at Z, to produce equilibrium, being a greater weight than in the former experiment, in consequence of greater tension being called into action by the greater obliquity of the rods; and a proof that in Mr. Dredge's construction there is not iron enough in the centre of the longitudinal beam to resist the tension existing there. This experiment showed much more rigidity than the former one, being more powerfully acted on; but to have manufactured it sufficiently strong to resist the tension, would have entailed a heavier outlay than the former.

There is no doubt but that this construction of making the longitudinal beam act centrally as part of the chain would tend to stiffen the structure, and might simplify the details in small spans; but in large spans, where the centre link is of great substance, and with a double chain, practical difficulties occur which would render the centre link a necessarily distinct feature, and prevent its absorption into the roadway beam.

The reason why the chains are drawn tangent to the railing is to enable the railing to be placed centrally under the chains; for if the chains were tangent to the roadway, though there would be a decrease in the height of the standards, there would be a loss of 2 feet in width of platform; for with a wide chain dipping below the railing, the stanchions supporting it must be placed 1 foot on each side, within the central line of the chain, in order to avoid contact with it; and an extra 2 feet of platform is more expensive in its consequences on the amount of iron than an additional 4 feet of masonry on the standards.

Experiment 3rd, of which Fig. 3 is illustrative, was a construction on the resultant principle, similar to experiment 1, carried to a much larger extent. The Fig. 3, shows only one half of it, as it was an entire curve of 490 feet between the points of suspension, the lengths of the

rods and beam, heights and distances, being to a full scale, whilst the sectional area of the iron was $\frac{1}{108}$th part of reality. The sections of the whole of the parts are given, and proof calculations that each was correctly proportional to the full sections of the actual bridge. The standards were formed of spars, firmly supported by struts in front* and stayed back with ropes and chains, the latter having tackle on them to correct the perpendicularity of the masts, should they yield to the load.

The horizontal beam was upheld by forty-four rods from the chain and six direct from each standard; the chain double, tapering in the centre to a power equal to $\frac{1}{8}$th the upper link.

The angle of the centre oblique rod 25°, and that of the one next the standard 38°; so that there was only a difference of 13° between the two extremes, divided amongst twenty-eight points, or a difference of tension between the extremes in the proportion of 2·63 to 1·62.

The deflection of the chain was equal to $\frac{1}{12}$th the span.

The section of the longitudinal beam at the centre, added to the section of the centre links, was equal to the sectional area of the upper links of the chain.

The whole of the experiment being, as before said, $\frac{1}{108}$th part of reality, is a model of the curve, which was designed for the Agra bridge, and the result of this experiment will go far to prove the correctness of the theory advanced.

The calculations show the proportional load for the experiment to be 1352 lbs., at the rate of 120 lbs. per square foot of platform, to be uniformly distributed over 56 points. This was done by slinging a basket at each point, and gradually loading them up to the amount of 57 lbs. each.

When loaded with 24 lbs. in each basket, or 51 lbs. per square foot (exclusive of weight of experiment), the deflection in the centre, after the masts were made upright, was $1\frac{3}{4}''$ only in the centre.

With an additional load of 16 lbs. per baskest, making in all 40 lbs., or $84\frac{1}{2}$ lbs. per square foot of platform, the deflection in the centre was $5\frac{1}{4}$ inches, and midway between the centre and standards, on one side $1\frac{1}{2}''$, and on the other $2\frac{1}{4}''$, on account of the greater flexibility of one mast than the other. When the full load of 57 lbs. on each point, or

* Left out in drawing, to prevent confusion.

120 per square foot, was put on, the deflection was $13\frac{1}{8}$ inches in the centre. This load was allowed to remain on 3 days: it was subsequently unloaded and re-loaded several times with nearly the same results; and after the lapse of 17 days from the period of its first being loaded, when all the weight was taken out of the baskets except 24 lbs., which is proportional to the weight of the suspended platform of the real bridge without the traffic weight, the longitudinal beam sprang up to within $\frac{3}{8}$ths of an inch of the horizontal line on which it was first constructed.

Thus was this very extended curve, formed of such exceeding slender material, not any of which could be proved before it was put together, found equal, proportionally, to the greatest amount of the traffic load that could on any extraordinary occasion come on the bridge, without derangement of any of its parts: the combination appeared as stiff under the load as could reasonably be expected with such slender wires, and fully bore out the results detailed in experiment No. 1, and the mathematical demonstration of the powers of the bridge, as set forth in the specification of the Agra bridge.

Subsequent to the above detailed loading, I continued adding weight to the baskets, and correcting the masts as well as the power of the tackle enabled me to do, till the weight in each baskest amounted to 81 lbs., when the longitudinal beam was torn asunder at the distance of 25 feet from the centre, and the whole immediately buckled up.

The breaking weight was therefore 174 lbs. per square foot of platform, or a tension of 15 tons per square inch of that slight material, the weldings of which were with difficulty made, and the strength of which there was no means of proving.

I cannot imagine any further proof to be necessary of the efficacy of such a system as has been proposed, manifestly having for its object the avoidance of the defects of both the uniform and extreme oblique system, combining the strength and solidity of the former with the rigidity, economy, and more scientific construction of the latter.

In this construction, admitting the action of tension in every direction, and where the rods and bars are drawn in the direction of their length, the full amount of tension that can possibly affect every part of the structure can be accurately ascertained, and thus certain data are afforded from which to proportion the sectional areas of every part of the bridge.

Scantlings of Rods of Experiment No. 3.

Each chain.		Of one inch.
	Upper link	$\frac{15}{32}$
	2 ,,	$\frac{29}{64}$
	3 ,,	$\frac{28}{64}$
	4 ,,	$\frac{27}{64}$
	5 ,,	$\frac{26}{64}$
	6 ,,	$\frac{25}{64}$
	7 ,,	$\frac{24}{64}$
	8 ,,	$\frac{23}{64}$
	9 ,,	$\frac{22}{64}$
	10 ,,	$\frac{20}{64}$
	11 ,,	$\frac{19}{64}$
	12 or centre,	$\frac{18}{64}$

Oblique rod $\frac{1}{8}''$ diameter.

Longitudinal beam at centre $1'' \times \frac{3}{16}''$.

,, ,, 7th space from centre $1'' \times \frac{9}{64}''$.

Explanation of the relative proportion between the Experiment and the real Bridge.

Full section of two chains, one side of the real bridge.

Upper link, 17 bars $2'' \times 1'' = 34'' \times 2'' = 68$ square inches.

Diameter of experimental upper link, $\frac{15}{32}$ of one inch.

Area of which ·178 and ·178 × 2 ch. = ·346 section of two chains.

·346 × 176 = 67·8, or section of real bridge.

Area of platform, real bridge, 468 × 11 = 5148 square feet :

5148 × 120 = 617760 lbs. on real bridge.

$\frac{617760}{196} = 3156$ lbs. total load for experiment.

$\frac{3152}{56} = 57$ lbs. on each point of experiment.

Area of oblique rods of real bridge 2·405 each.

Diameter of rods of experiment $\frac{1}{8}''$ or sectional area ·012 :

·012 × 196 = 2·352, or very nearly the section of real bridge.

Sectional arc of longitudinal beam of real bridge at centre, 37 inches; remainder $27''$ beyond the 7th oblique rod.

Sectional of experimental beam at centre $1'' \times \frac{3}{16}'' = \cdot 188$; and $\cdot 188 \times 196 = 36\cdot 848$, or nearly the section of real bridge.

Remainder of section, $1'' \times \frac{9}{64}'' = \cdot 141$ at the 7th rod:

$\cdot 141 \times 196 = 27\cdot 636$, as nearly as possible the section of real bridge.

Table explanatory of the previously calculated theoretical tensions, and subsequently practically proved results, on an experiment undertaken to test the Taper Chain "Resultant" system.

	Oblique rod forces.			*Chain link forces.*		*Total tension horizontal line.*				*Total tension upper line.*			
	Previously calculated.	Practical result.	Difference.		Practical result.		Previously calculated.	Practical result.	Difference.		Previously calculated.	Practical result.	Difference.
x or a	68			b	814								
or a′	74	95	21	b′	750								
x^2 or a^2	81	102	21	b^2	678								
x^3 or a^3	92	107	25	b^3	596	**Y**	406	519	113	**Z**	814	1068	272
x^4 or a^4	104	132	28	b^4									
x^5 or a^5	112	145	33	b^5									

Bal'amy's translation of the History of Tabary, and Ghazzály's History of the Prophets.—By A. Sprenger, *Esq. M. D.* (*Communicated by* H. M. Elliot, *Esq. Vice-President.*

Messrs. Silvestre de Lacy and Dubeux complain justly of the great incorrectness of the copies of the Persian translation of Tabary, and their discrepancy from each other, which is so great that little reliance can be placed on the book; that which is affirmed in one copy is not seldom contradicted in another. I thought this circumstance might be owing to a difference of original editions made by the author himself; a comparison of several copies however does not bear out this hypothesis; the various readings cannot be reduced to a certain number of original texts.

If we consider the age when Tabary was translated (between A. H. 350 and 366) and the comparatively modern language of the copies which we possess, another hypothesis suggests itself, viz. that these corruptions and discrepancies are owing to attempts on the part of the copyists to improve the obsolete expressions of the original. Though I have never met with a very ancient MSS. of Bal'amy's Tabary, this supposition has been confirmed by the discovery of a work of Imám Ghazzály (who died A. H. 505), which I believe has hitherto escaped the attention of bibliographers.

In the Moty Mahal library of the king of Oudh is a Persian MS. in 4to. of 250 pages, with the following title page written in the same hand in which the text is written:

كتاب قصص الانبيا صنفه الامام العالم العلامة حجة الاسلام هادي الانام سيد
الحكماء سلطان العلماء جامع العلوم وحاوي المناقب محرز الفضائل زين الدين
ابو حامد محمد بن (sic) الغزالي

"History of the prophets, compiled by the learned Hojjat al-islam Zayn al-dyn abú Hámid Mohammad, the son (sic) of Ghazzály (sic)." The MSS. is executed in a very beautiful naskhy character, and is the most ancient, and one of the most correct *Persian* MSS. that I have seen. It was probably written in the sixth century of the Hijrah, and abounds in peculiarities in spelling, as will appear from the extracts given below.

3 M 2

On comparing this book with the Persian translations of Tabary it appears that the latter embodies the whole of the former. It is indeed likely that the History of the prophets of Ghazzály is nothing more than an abridged edition of Tabary. This seems to be borne out by the circumstance that the invocation of God and of the prophet,* with which every Mohammadan book begins, is literally the same in our copy of Tabary and in Ghazzály, only the words قال ابو جعفر محمد بن جرير الطبرى are omitted by the latter. In the same copy of Tabary we find the beginning of the first chapter of Ghazzály preceded by the words "know that Abú Jáfar Mohammad b. Jaryr Tabary says in the beginning of his work." But in another copy of Tabary, this passage is wanting, and there is a different invocation† of God and the prophet. On the other hand, as the Persians have taken so great liberties with their translation of Tabary, it is possible that they have inserted the whole of Ghazzály's book into it.

Be this as it may, this valuable MSS. enables us to restore a large portion of our copies of Tabary; moreover it is of great intrinsic value; it contains the passages of the Korán alluding to the ancient prophets, most skilfully arranged and connected, and illustrated in a natural manner and with great perspicuity. It is the only book which gives us a clear view of *Mohammad's* notions of the prophets; all other Mohammadan books on the subject are filled with fables, which not only belong to a later time but to different countries. Here is the index of Ghazzály's history,‡ which differs but little from that of Tabary.

* It begins: الحمد لله الاول قبل كل اول والاخر بعد كل اخر والدايم الخ

† It begins: الحمد لله العلى الاعلى الوافي من الى الوفي ذي الاسماء الحسني الخ

‡ An index to Tabary is contained in the Zeitschrift der Detschen Morgenl. Gesellsch. II. 2. p. 159. See also DuCrux's translation of Tabary.

40. Arrival of Joseph's brothers, 66.

41. Job, 72.

42. Sho'ayb, 74.

43. Moses, 78.

44. Birth of Moses, 79.

45. Flight of Moses to Madyan, 83.

46. Prophetic mission of Moses, 85.

47. God speaks to Moses, 85.

48. Moses goes to Egypt to Pharaoh, and with Aaron he conveys to him the message, fol. 89.

49. Pharaoh is drowned and the Israelites leave Egypt, 95.

50. Moses goes to speak with God and the Israelites worship the golden calf, 99.

51. History of the cow and the carnage among the children of Israel, 106.

52. Moses and Khidhr, 109.

53. Moses and the Israelites leave Egypt; they come into the country of the giants, whom they fight at Jericho, in the Balqá and at Jerusalem, 112.

54. Death of Moses and Aaron in the desert, 115.

55. Joshua heads the Israelites and fights the giants, 116.

91. The Table, 119.

92. The town on the sea shore, 119.

93. Christ's ascension to heaven, 120.

94. Death of the Virgin Mary, and execution of John Baptist, 122.

95. Kings of the Romans, from Christ to Mohammad, 122.

Unfortunately the copy is defective and gone; the most important chapters are wanting, the lacuna is after chapter 55. I give here the heads of the wanting chapters according to the index of the book.

56. Qárún and Moses.

57. The kings of the Israelites after Moses and the march of Manújchr.

58. Kaykobád.

59. The prophet Hizqyl.

60. The prophet Elyás.

61. Alyása' and the kings of the Israelites after him.

62. Samuel.

63. Samuel and Tálút

64. War of Tálút with Jálút (Goliath). David slays Jálút.

65. Tálút, his intention to kill David and how God leads him into his own snare.

66. David.

67. Solomon.

68. Solomon and Bilqys.

69. Solomon and the Devil; his temptation; an image is put on his throne (Korân 38, 33.)

70. Death of Solomon.

71. The Ant in the story of Solomon and David.

72. The Horses in the story of Solomon and David.

73. Rehoboam son of Solomon.

74. Kishen and Zarj, the king of India.

75. The prayer which was acceded to.

76. Kings of the Israelites.

77. King Lohrásp.

78. His son Gushtásp.

79. Kings of Yuman after Solomon.

80. Buhman and his son Dárá whom he begat by his daughter Homáy.

81. The elder Dárá.

82. His son the younger Dárá.

83. Dzú al-Karnayn (Alexander) and his reign.

84. Greek kings after Alexander; the kings of the Satrapies.

85. Birth of Mary and how she was destined to serve God (Korân 3, 31.)

86. Birth of John Baptist.

87. Birth of Christ.

88. Flight of Mary and Christ.

89. Zacharias put to death; prophetic mission of his son John.

90. Prophetic mission of Christ.

History of Húd.

From the time of Noah to the time of Abraham, which is a space of one thousand two hundred years, there was no prophet except Húd, whom God sent to the 'Ádites and Çálih, whom he sent to the Thamú-

dites. 'Ád and Thamúd were not two kings but two tribes descended from Shem the son of Noah. The father of our tribe was 'Ád the son of Uz b. Arem b. Shem b. Noah. The father of the other tribes was Thamúd b. Gether b. Arem b. Shem b. Noah. 'Ád had many children who were collectively called 'Ád ('Ádites). Thamúd had also many children and they were called Thamúd (Thamúdites). In the Korân the people of 'Ád are called 'Ád and Iram (Aremites). It is said in the Korân (86, 3). "Dost thou not see how thy Lord acted with 'Ád and Iram." Sometimes they are called by this name and sometimes by the other. Tabary observes in this book that the commentator of the Korân and the learned said: the reason why it runs in the Korân "their brother and not his brother" is that under the name of Thamúd the tribe of Thamúd is to be understood "To Thamúd we sent their brother Cálih" and not "his brother."

The 'Ádites and Thamúdites lived in the steppes of the Hijáz between the territory of Makkah and Syria. The country of the 'Ádites was near to the country of Makkah, but the country of the Thamúdites was farther from Makkah (this is precisely the position which Ptolemy assigns to his Tamuditæ and Oaditæ. The 'Ádites seem to have been still existing in the second century after Christ. All Mohammadan authors besides Tabary and Ghazzály say that the 'Ádites lived in the uninhabitable desert of Ahqáf, the latter inhabited a district called Hijr, which is on the frontier of Syria on the extremity of the steppes of the Hijaz. "The inhabitants of Hijr have accused the prophets of falsehood." The inhabitants of Hijr in this passage are the Thamudites. The 'Ádites and Thamúdites were the descendants of cousins and descended from Iram, but the 'Ádites flourished earlier and the Thamúdites by two hundred years later. The 'Ádites are also called the first 'Ádites and the Thamúdites are called the second 'Ádites. In the Korân whenever one of the two is mentioned the other is mentioned as well, and the name of the 'Ádites stands first, and that of the Thamúdites last: as (26, 123.) "The 'Ádites accused the prophets of falsehood," and subsequently (v. 141), the Thamúdites are mentioned again (41, 14). "As to the 'Ádites they were overbearing on earth," and after that (verse 16) "and as to the Thamúdites, &c." In another passage it is said the 'Ádites and the Thamúdites. The same is the case wherever they are mentioned.

The 'Ádites were stronger in body and more powerful than the Thamúdites. There was no nation on earth equal to the 'Ádites in tallness or strength. Every man was twelve spans high and some of them were so strong that if they struck the foot on the dry ground they would sink into it to the knee. They built houses in their country which were in keeping with their strength and of almost everlasting construction up to this day: if you see a strange building it is called 'Ádian "Iram dzát imád, &c." It is said in the Korân "Do you not know how God has acted with the 'Ádites, who were the Lords of 'imád." 'Imád is a pillar and the meaning of the passage is that they were in stature like pillars; every one of them was like several pillars in height and strength. In another passage they are compared with palm roots "they are like palm roots strewed about on the ground."

They were idolators: God sent Húd to them who was the son of their uncle; his name in Hebrew is Gháther. In the Korân he is called their brother "their brother Húd." Brother has a double meaning, brother by relationship and brother in faith. Húd was their brother by relationship and not by religion. Húd called them to God saying: "O people, worship God, you have no God besides him." Proud of their strength they said to him "Who is stronger than we?" They were fifty thousand men strong, and then therefore they said "what tribe is more numerous than we?" "Do you not see that God who has created them is stronger than they are?" Húd was incensed and said "Do you build a landmark on every place to direct yourselves? And do you erect strong edifices hoping that you may continue to live for ever," "and if you are at feud you are at feud with giants; you seize them without mercy and you do not let them loose before they are dead, fear God and obey him." After this Húd enumerated to them the bounty of God. "Fear that God who has given you what you know, who has given you cattle, children, gardens, and springs of water." Cattle are mentioned first in this passage, because the wealth of the sons of the desert consists in the sheep, cows, camels and the like. The reason why first their property is mentioned and then their children, is that children may be a misfortune, and a rich man can easily obtain children. In another passage it is said "wealth and children." Here again wealth is placed before children, because wealth is most esteemed with men. Húd preached fifty years but they answered him "it is of

no consequence for us whether you preach or not." "O Húd, thou assertest that these our Gods are no Gods, but you do not prove it, and therefore we will not give up our Gods on thy telling us to do so, and we will not obey thee." "We are certain thou art mad, and these our Gods, whom thou dost not worship have made thee mad."

In short Húd preached to them fifty years and no body believed in him, and those who did believe in him held their faith secret, and did not show their faith openly. After a long time Húd despaired of success. God knew that no one believed, and decided on punishing them; their spring of water which we have mentioned, became dry, and all their cattle died; they had three years no rain; they suffered of draught. It was the habit in the whole of Shám to go to Mukkah and offer there sacrifices and invoke God, though the inhabitants of Shám were unbelievers. At that time not a trace of the Kábah was left, having been destroyed by the deluge, and it was not rebuilt before the time of Abraham. This prophet (who lived later than Húd) raised the temple again. Yet the unbelievers knew that the soil of Makkah was sacred heaven, and they had preserved tradition, from the time previous to the flood, that there had been the house of God. The sacred territory was therefore always esteemed, and every one who was in need was aware that none but the God of heaven could help him. If they wished that a sick person should recover, or if a prisoner was in the hands of the enemy, or if there was an oppressor with whom they could not cope, they went to the spot on which now Makkah stands, offered sacrifices and invoked God on the top of that hill. The cause of this was that God never left the world without evidence of his existence, nor was mankind ever in complete ignorance. It is true there was no prophet in those days who showed to mankind the road, but God made the sacred territory the proof of his existence, for as they were there assisted in their needs, and as they saw these miracles, they knew that there was a God besides those idols and that he does all these works. This was the proof of God for mankind which left no excuse for an infidel who might say I did not know better, or I have not heard the name of God, there was a proof of the existence of God and it was just that those who would not believe should be thrown into hell.

When the 'Adites were in great distress they said: Let us send messengers and sacrifices into the sacred territory that they may pray

and that we may obtain rain. They sent a man of the name of Loqmán. He was the eldest, the most influential, and the strongest man among them, and was nearest to 'Ád in descent: he was Loqmán son of Loqaym and grandson of 'Ád, and was secretly united with the prophet Húd. They also sent another man of the name of Marthad b. Sa'd who professed the religion of Húd and who was equally one of their chiefs; there was another man with them of the name of Qayl, who was an unbeliever and an adversary of Húd, but he was the greatest chief of the three, they sent these three men with much cattle, sheep, cows and camels, and they gave them orders to sacrifice them at Makkah and to pray for rain from God. The distance to Makkah was three days' journey, Húd said to the 'Ádites: "O people, believe in me that God may give you rain if you want it. Pray God for pardon, then repent your sins and he will give you fair enjoyments, and he will increase your strength." But they shut their ears to the admonitions of Húd and dispatched these three men to the country of Makkah. They had relations at Makkah who lived on the hill. The tribe of Mo'awiyah b. Bokr received them as guests, and told them to enjoy three days their hospitality and then to attend to the object of their mission; they spread the tables, gave them wine to drink and amused them with the singing of slave girls. One whole month they spend in drinking and did not think of their tribe. After the lapse of this time their hosts became mindful that they had forgotten their tribe, and they were sorry first, for the 'Ádites were their relations, yet they were ashamed to turn them out of their houses and make them attend to their work. They therefore taught a song to the slave girls that they might call to their mind in music the drought of their country. As soon as the messengers had heard the singers mention their tribe their memory was awoke and they said we have committed a great error in forgetting our countrymen: they broke up in order to perform the sacrifices. Marthad and Loqmán who believed in Húd professed their faith and said to Qayl who was an unbeliever, if our tribe was to believe in Húd, it would rain by itself and there would be no need of these sacrifices. Qayl knew that they believed in Húd; he was not afraid of the destruction of the tribe, and left them and went on the top of the hill; the place for sacrificing was on the hill of Minà. He killed the sacrifices turned his face towards the heaven and said, O God of

heaven, thou knowest that I am come here in need; my need is not sickness from which I wish to be relieved, nor captivity from which I want liberation, but I want rain for my tribe who are nearly perishing from thirst. He thus spoke and prayed until three clouds made their appearance in the air, one was white, one red, and one was black. A voice came from the wind: Choose which of the three clouds thou wantest, that it may go to thy tribe! He said to himself I know that this white cloud is dry and that it contains no rain; I do not know what there is in the red cloud; but in the black cloud is rain, for if a black cloud comes its rains. He therefore exclaimed I wish that the black cloud should go to my tribe. In this black cloud was the wind of destruction. God ordered the angels of destruction to bring the black cloud to the country of the 'Ádites. Qayl descended from the hill and went to his two companions, and said a black cloud came with rain and I sent it to my tribe, saying this he sat down with them to drink; the cloud went to the 'Ádites and it was preceded by a wind. When the cloud came near they were delighted that wind, clouds, and rain were coming, "and when they saw it coming to their valleys they said this will bring rain." But Húd knew that it was the punishment; for God had informed him thereof and he said, "On the contrary this is what you have brought untimely upon yourselves; it contains wind by which a painful punishment will be inflicted upon you." When it was over their heads it stopped, and a sterile wind broke forth from it—"And in the 'Ádites when we sent against them a sterile wind"—'Aqym (sterile) is that from which there flows no advantage. Wind may be very useful after this world, it brings water for trees and makes them fertile, it propels ships on the sea, it carries sweet odors, it cools water, but a wind which has none of these advantages is called 'Aqym (sterile). In another passage of the Korân the wind is called 'Áty (destructive)—"As to the 'Ádites they were destroyed by a cold and destructive ('Áty) wind." All the quadrupeds which they had, were taken up from the ground by the wind and carried into the air, from whence they fell to the ground and were dashed to pieces. "Whatever it touched was reduced to rotten bane." When they saw this they said, have patience, for after the wind it will rain. They went out of their houses into the open field were they sank into the ground to their thighs and stood there with great courage. Húd thought they were

coming to him in order to express their wants, and that they would believe in God but they did not believe. The wind came and took every one of them up from the ground and carried him up into the air from whence he fell to the ground and died. They were strewed over the ground like trees, "as if they were palm trees thrown on the ground;" "they are like the roots of torn up palm trees," whoever fled was overtaken by the wind thrown to the ground and killed. The women had remained in their houses, they were equally raised from the ground and struck against the walls until they were dead. This wind lasted a whole week. "God caused the wind to assail them seven nights and days successively." Not a soul of them remained alive except Húd and those who believed in him: they suffered no harm from the wind. "When we sent the punishment we saved in our mercy Húd and those who believed, we saved them from the heavy punishment." The three men sent to Makkah were during all this time in that city feasting and remained ignorant of the fate of their tribe, until a man of another tribe who had passed the valley of the 'Ádites and had seen them, arrived at Makkah and give intelligence that they had all perished except Húd and those who believed. The two believers rejoiced, but Qayl, who was an unbeliever, was sorry; he got up and ascended the hill of Minà; Loqmán and Marthad accompanied him, and said to him, believe in Húd, to avoid thy destruction. He answered, I have no object in life since my friends are dead, and raising his head he exclaimed: O God of heaven, if it is true that my tribe is destroyed, destroy me as well. A wind came which took him up from the top of the mountain, threw him on the ground, and killed him. The two men who believed in Húd heard a voice which proceeded from the hill: "Whatever each of you wisheth ye shall have." Marthad b. Sa'd said, I wish that I should have a sufficient quantity of wheat to be able to afford to eat wheaten bread all my life. He obtained it; he descended from the hill and went to Makkah where he remained till he died. Loqmán said, I wish to have a long life. He heard a voice, saying: However long thou mayest live thou must die in the end. He answered, grant it! The voice said thou shalt have the life of seven vultures! He also settled at Makkah. He used to visit the top of a hill where the vultures laid their eggs and watch the chickens. When they came from the egg he took them away and took care of them.

Thus he kept seven vultures in succession, the last was called Lobad. Loqmán and Lobád died at the same time. Tabary observes that a vulture lives eighty years; but according to other accounts, they live longer. Húd remained with his follower in the country of 'Ád and lived fifty years after the 'Ádites and died at an age of 150 years. There was no prophet for one hundred years after Húd until the time of Çálih and of the Thamúdites. There were only kings, and every one had a different religion, one was an idolater, another was a fire-worshipper, &c. This continued to the time of Çálih.

Ghazzály.

١ القول في المعنى الذي خلق الله الخلق من اجله *

٢ حديث عبدالله بن عباس عن النبي عليه السلام في صفة الشمس و القمر *

٣ القول في مقدار مدة الدنيا *

٤ القول في صفة الخلايق وفي كم كان ذلك *

٥ ذكر اول من اسكنه من البشر *

٦ ذكر سجود الملائكة لآدم عليه السلام *

٧ ذكر مخدعة ابليس لآدم و حوا *

٨ ذكر هبوط آدم من الجنة *

٩ ذكر حج آدم عليه السلام *

١٠ حديث قتل قابيل لهابيل *

١١ القول في اخراج الذرية من صلب آدم *

١٢ نبوة آدم و ابنه شيث *

١٣ سوال ابو ذر غفاري وفات آدم *

١٤ ذكر شيث بن آدم و اولاده من بعده ومن ملك *

١٥ ذكر اول من عبد النار و اتخذ المعارف *

١٦ قصة ادريس عليه السلام *

١٧ قصة نوح عليه السلام *

١٨ قصه نمرود بن كنعان *

١٩ قصه هود عليه السلام *

٢٠ قصه ثمود و صالح النبي عليه السلام *

٢١ قصه ابراهيم الخليل عليه السلام *

٢٢ ذكر هجرة ابراهيم عليه السلام *

٢٣ ذكر هلاك النمرود عليه اللعنة *

٢٤ مولد اسمعيل عليه السلام *

٢٥ اسكان ابراهيم لاسمعيل عليه السلام *

٢٦ زيارة ابراهيم لاسمعيل عليه السلام *

٢٧ ذكر قوم لوط و مولد اسحق عليه السلام *

٢٨ حديث ضيف ابراهيم عليه السلام *

٢٩ قصه ذبح ابراهيم ولده عليهما السلام *

٣٠ بناء ابراهيم و اسمعيل البيت عليهما السلام *

٣١ وفاة سارة رضي الله عنها *

٣٢ وفاة ابراهيم عليه السلام *

٣٣ قوله رب ارني كيف تحيي الموتى *

٣٤ قصه اسمعيل و نبوته و وفاته *

٣٥ قصه اسحق عليه السلام *

٣٦ قصه عيص و يعقوب *

٣٧ قصه يوسف عليه السلام *

٣٨ قصه زليخا و يوسف *

٣٩ خروج يوسف عليه السلام من السجن *

٤٠ ورود اخوة يوسف عليه السلام *

٤١ قصه ايوب عليه السلام *

٦٥ حديث الياس النبي *

٦٦ حديث اليسع و الملوك الذين كانوا من بعده في بني اسرائيل *

٦٧ حديث اشموئيل النبي *

٦٨ حديث اشموئيل و طالوت *

٦٩ حديث حرب طالوت مع جالوت و قتل داؤد جالوت *

٧٠ حديث طالوت و ماهمّ به من قتل داؤد و كفاه الله شره *

٧١ حديث داؤد *

٧٢ حديث سليمن بن داؤد *

٧٣ حديث سليمن النبي مع بلقس *

٧٤ حديث سليمن مع الشيطان الذي فتن به والقي على كرسية *

٧٥ وفات سليمن *

٧٦ حديث النمل من اخبار سليمن بن داؤد *

٧٧ حديث الخيل من اخبار سليمن بن داؤد *

٧٨ حديث رخبعم بن سليمان بن داؤد *

٧٩ حديث كيشان و زرج ملك الهند *

٨٠ ذكر دعاىء مستجاب *

٨١ خبر الملوك الذين ملكوا على بني اسرائيل *

٨٢ ذكر بهراسب الملك *

٨٣ ذكر كشتابت بن بهراسب *

٨٤ حديث ملوك العجم بعد سليمان بن داؤد *

٨٥ حديث بهمن وابنه دارا من ابنته هماى *

٨٦ حديث دارا الاكبر و ملكه *

٨٧ حديث داراء الاصغر بن داراء الاكبر *

٨٨ حديث ذوالقرنين و ملكه *

۸۹ حدیث الملوک الیونانیین من بعد ذوالقرنین و اخبار ملوک الطوایف *

۹۰ مولد مریم وتحریرها *

۹۱ حدیث مولد یحیی بن زکریا *

۹۲ حدیث مولد عیسی *

۹۳ حدیث هجرة مریم وعیسی *

۹۴ حدیث مقتل زکریا و نبوة ابنه یحیی *

۹۵ حدیث نبوة عیسی *

The following extracts will enable the reader to compare the ancient ext of Tabary as preserved by Ghazzály, with the modern text, as found n our copies of Tabary. I still hope that a copy of the original will e discovered in India or in Persia.

Text according to our copies of Tabary.	*Text according to Ghazzály.*
و درین ایام پیامبر نبود اندر جهان	و از وقت نوح تا بوقت ابراهیم بدین
مگر هود پیغامبر و صالح پیغامبر که	هزار و دو بیست سال درپیغامبري
هود را علیه السلام بسوی قوم عاد	نبود مگر هود کی او را سوی قوم عاد
فرستاد خدای تعالی و صالح علیه السلام	فرستاد ایزد تعالی و صالح را سوی
را بسوی قوم ثمود و این عاد و ثمود	قوم ثمود فرستاد و عاد و ثمود ملك
نه ملك بودند لیکن دو قبیله اند از	نبودند ولیکن دو قبیله بودند از فرزندان
فرزندان سام بن نوح علیه السلام یك	سام بن نوح و یکی قبیله را پدر عاد
قبیله را نام پدر عاد بن عوض بن سام	بن عُوض بن ارم بن سام بن نوح بود
بن نوح علیه السلام و این هر دو را	ویکی قبیله را پدر ثمود بن حابر بن
فرزندان بسیار بودند وهر قبیله را بنام	ارم بن سام بن نوح بود پس عاد را
پدر خواندندی چنانکه بني تمیم	فرزندان آمدند بسیار همه قبیله را عاد
وبني اسد پس خدای تعالی آن همه	خواندندی و ثمود را فرزندان آمدند

Text of Tabary.

قوم را بعاد خواند و گفت وَالیَ عَاد
اَخَاهُمْ هُودًا اخاهم گفت و نه گفت
اخاه ازانکه یك تن را نخواست وهمه
قبیله را خواست چون ایشان را پدر
عاد بود خدای تعالی ایشانرا هم بعاد
خواند وهم بارم و ایدون گفت اَلَمْ تَرَ
كَيْفَ فَعَلَ رَبُّكَ بِعَادٍ اِرَمَ و هردو پدر
ایشان بودند و همچنین ثمود را نام
برد و قوم ثمود را خواست چنانکه
گفت وَالَی ثَمُودَ اَخَاهُمْ صَالِحًا عاد و
ثمود هردو گروه بیکجای نزدیك بودند
ببادیه حجاز میان زمین مکه و شام
زمین عاد بمکه نزدیکتر بود و زمین
ثمود زمینی بود نام او حجر و ان بطرف
شام بود بکنار بادیهٔ حجاز چنانکه
خدای تعالی گفت وَلَقَدْ كَذَّبَ اَصْحَابُ
الْحِجْرِ الْمُرْسَلِيْنَ و اصحاب حجر قوم
ثمود بودند وقوم ثمود وقوم عاد هردو
گروه عم زادگان بودند وثمود از فرزندان
ارم بن سام بن نوح بودند علیه السلام
لیکن قوم عاد بیشتر بودند وقوم ثمود
کمتر ومیان ایشان دویست سال بود
وعاد را عاد اول خواندند و ثمود را ثمود

Text of Ghazzály.

بسیار همه قبیله را ثمود خواندندی
وخدای تعالی قوم عاد را بعاد باز خواند
وهم بارم وگفت قوله تعالی اَلَمْ تَرَ كَيْفَ
فَعَلَ رَبُّكَ بِعَادٍ اِرَمَ گهی بدین باز
خواند وگهی بدان ومحمد جریر گوید
بدین کتاب اندر کی مفسدان وعلما
گفته اند تا بدانی کی چرا گفت اخاهم
ونگفت اخاه وهم چنین نیز ثمود را
نام برد وقوم ثمود را خواست قوله تعالی
وَالَی ثَمُوْدَ اَخَاهُمْ صَالِحًا ونگفت اخاه
عاد وثمود هردو گروه ببادیهٔ حجاز
بودندی میان زمین مکه و زمین شام
وزمین عاد بمکه نزدیك بود وزمین
مکه از ثمود دور تر بود و بزمینی بود
نام او حجر وبرطرف شام بود بکنارهٔ
بادیهٔ حجاز قوله تعالی وَلَقَدْ كَذَّبَ
اَصْحَابُ الْحِجْرِ الْمُرْسَلِيْنَ واصحاب
الحجر قوم ثمود بودند وثمود وعاد
هردو گروه عم زادگان بودند واز فرزندان
ارم بودند ولیکن قوم عاد پیشین بودند
وقوم ثمود بسین ومیان ایشان دویست
سال بود وعاد را عاد اول خواندند وثمود را
عاد الثانی خواندند و در قران هرجا کی

Text of Tabary.	*Text of Ghazzály.*
ثاني وچون بقران اندر نگري هر کجا	حديث ايشان آمده است هر دو را بايك
حديث ايشان ياد كرد نخست عاد را	ديگر ياد کنند نخست عادرا پس ثمودرا
ياد كرد پس ثمود را و ايدون گفت	قوله تعالى كَذَّبَتْ عَادُ الْمُرْسَلِيْنَ وانگاه
كَذَّبَتْ عَادُ الْمُرْسَلِيْنَ وآنكه گفت ثمود	گفت ثمود قوله تعالى فَاَمَّا عَادُ فَاسْتَكْبَرُوْا
و ديگر جاى گفت فَاَمَّا عَادُ فَاسْتَكْبَرُوْا	فِي الْاَرْضِ پس گفت و اما ثَمُوْد وگفت
فِي الْاَرْضِ وعاد از ثمود قوي تر بودند	وعاد را وثمودرا وهر كجا ايشانرا ياد
بخلق و نيرو وبجهان اندر خلق نبود	كرده است وعاد از ثمود قوي تر بود
ببالا ونيرو و قوم عاد و هر دو مردى	بخلق وبنير وتر وبجهان خلقى نبود
را دوازده ارش بالا بود و چنداني	ببلا ونيروى قوم عاد وبالاى هر مردى
نيرو بود كه پاى بر زمين برزدندى	دوازده ارش بود چندان نيرو داشتى
تا زانو برفتى وبدان زمين اندر بناها	كى پاى بر زمين خشك زدى تا زانو
كردند چنانكه جا و دانگى باشد و تا	بزمين فرو بردى و بدان زمين خويش
امروز هرجا كه بناى بزرگ است	اندرخانها كردند اندرخوردشان چنانكه
و قوي است انرا بناى عاد ميخوانند	جاويدان باشد از قوت بنياد و امروز
و هر مردى كه بزرگ و قوي بود انرا	هر كجا بنيادى استوار تر بيني انرا
عاد ميگويند چنانكه گفت جلّ و علا	عادى خوانند قوله تعالى اِرَمَ ذَاتِ
اَلَمْ تَرَ كَيْفَ رَبُّكَ بِعَادٍ اِرَمَ و معني	الْعِمَادِ الَّتِي لَمْ يُخْلَقْ مِثْلُهَا فِي الْبِلَادِ
اَلَمْ تَرَ بسمع باشد بقول مفسران گفت	گفت نشنيدي كى خداى عزوجل چگونه
نشنيدي يا محمد كه خداى تعالى	كرد بقبيله عاد خداوندان عماد وعماد
بقبيله ارم ذاتِ العماد چه كرد خداوند	ستون بود يعنى كي بالاى ايشان
ستون بودند وستون از بالاهاى و راز	بستون مي ماند وهر يكى چند ستون
ايشان خواست گفتا هريكى ستوني	بودند از بالا و قوت و جاى ديگر
بودند از بالا و قوت وجاى ديگر ايشانرا	ايشانرا بنخر مانيان مانند كردند

Text of Tabary.

به خرمانیان نسبت کرد و اَیدُون گفت
کَاَنَّهُمْ اَعْجَازُ نَخْل خاویة پس بدرازي
وقوت ایشانرا به خرمانیان و ستونها
مانند کرد و از ذات العماد قبیله را
خواست پس گفت اَلَّتِي لَمْ يُخْلَقْ
مِثْلُهَا فِي الْبِلَادِ هم قبیله را خواست
که چون ایشان خلق نبود بر زمین
و ایشان بت پرست بودند و بتان
داشتند بسیار و خدای تعالی هود
علیه السلام را بایشان فرستاد بپیامبري
و هود علیه السلام پسر عم ایشان بود
و از فرزندان نوح علیه السلام و هود
بزبان تازي است و بعبراني عابر بود
بن شالخ بن ارفخشد بن سام نوح
علیه السلام و خدای تعالی ایشانرا
برادر هود خواند وایدون گفت اَخَاهُمْ
هُوْدًا و برادران از دوگونه بودند یکی
بقرابت برادر در دین وهود علیه السلام
ایشانرا بخدای خواند و گفت يَا قَوْمِ
اَعْبُدُوا اللّهَ مَا لَكُمْ مِنْ اِلهٍ غيره گفت
خدایرا پرستید و بت مپرستید که
شما را جز حق سبحانه تعالی خدای
نیست واگر نه پرستید شما را عقوبت

Text of Ghazzály.

گفت كَاَنَّهُمْ اِعْجَازُ نَخْلٍ خَاوِيَةٍ وبت
پرست بودند خدای تعالی هود را
بایشان فرستاد و هود پسر عم ایشان
بود و بعبراني نام او غابر بود و در
قران برادر شان گفت اَخَاهُمْ هُوْدًا و
برادر دو کس را گویند برادر بقرابت
و دیگر برادر در دین وهود بقرابت
برادر بودند بدین وهود ایشان را دعوت
کردو بخدای خواند وگفت قوله تعالی
يَا قَوْمِ اعْبُدُوا اللّهَ مَا لَكُمْ مِنْ اِلهٍ غيره
گفت خدای عز وجل را بپرستیدکي
شمارا جز از و خدای دیگر نیست والاّ
شمارا عذاب کند ایشان بدان زور ونیروی
خویش فریفته شدند و گفتند مَنْ
اَشَدُّ مِنَّا قُوَّةً از ما قوي تر کیست کی ما را
عذاب تواند کردن و پنجاه هزار مرد
بودند گفتند و از ما بیشتر کیست
بشمار قوله تعالی اَوَ لَمْ يَرَوْ اَنَّ اللّهَ
الَّذِي خَلَقَهُمْ هُوَ اَشَدُّ مِنْهُمْ قُوَّةً یعني
ندانست کی آن خدای کی مر ایشانرا
آفریده قوي تر است پس هود ایشانرا
عتاب کرد و گفت اَتَبْنُوْنَ بِكُلِّ رِيْعٍ آيَةً
تَعْبَثُوْنَ وَ تَتَّخِذُوْنَ مَصَانِعَ لَعَلَّكُمْ

Text of Tabary.

کند ایشان بقوت تن فریفته شدند و
گفتند مَنْ اَشَدُّ مِنَّا قُوَّةً ازما قوي تر
نیست که ما را عذاب کند و عدد
ایشان بیش از پنجاه هزار مرد بود
و گفتند کیست از ما قوي تر و بیشتر
که ما را عذاب کند خدای تعالی گفت
اَوَلَمْ يَرَوْا اَنَّ اللّٰهَ الَّذِي خَلَقَهُمْ هُوَ
اَشَدُّ مِنْهُمْ قُوَّةً معني اولم یر و اینجا
اولم یعلموا است گفت ندانستید که
آن خدای که ایشانرا بیافرید از ایشان
قوي تر است پس هود علیه السلام
ایشانرا عتاب کرد ایدون گفت اَتَبْنُونَ
بِكُلِّ رِيْعٍ آيَةً تَعْبَثُونَ گفت بهرجا بنا
همي کنید وَتَتَّخِذُونَ مَصَانِعَ لَعَلَّكُمْ
تَخْلُدُونَ و کوشکها بنا همي کنید و
بمحکمی واستواری چنانکه درین جهان
جاودان مانید وَاِذَا بَطَشْتُمْ بَطَشْتُمْ
جَبَّارِينَ چون کسی را خشم گیرید
چون جباران و خشم گرفتن جباران
آن بود که نه رحمت بود و نه بخشایش
ودست ازو باز ندارند تا اورا هلاک
نکنند فَاتَّقُوا اللّٰهَ وَاَطِيعُونِ از خدای
بترسید ومرا فرمان کنید پس نعمتهای

Text of Ghazzály.

تَخْلُدُونَ گفت بهر جای چیزی همي
بنا کنید چنانکه بازي کنید و کوشکها
همي بنا کنید محکم و استوار چون
کسی کی او بدین جهان جاویدان
خواهد ماند وَاِذَا بَطَشْتُمْ بَطَشْتُمْ جَبَّارِينَ
وچون کسی را بخشم بگیرید گرفتن
جباران گیرید بی رحمتي و بی بخشایشي
و دست ازو باز ندارید تا او را هلاک
نکنید فَاتَّقُوا اللّٰهَ وَاَطِيعُونِ از خدای
عزوجل بترسید ومرا فرمان کنید
پس نعمتهای خدای بریشان مي شمرد
قوله تعالی وَاتَّقُوا الَّذِي اَمَدَّكُمْ بِمَا
تَعْلَمُونَ اَمَدَّكُمْ بِاَنْعَامٍ وَبَنِينَ وَجَنَّاتٍ
وَعُيُونٍ اِنِّي اَخَافُ عَلَيْكُمْ عَذَابَ يَوْمٍ
عَظِيمٍ گفت بپرهیزید از ان خدای
بزرگ کی شما را ازین جهان آن داد
کی شما دانید چهارپایان و فرزندان
داد و باغهای و چشمهای آب و بهر
ان چهارپایان یاد کردکی مردمان
بیاباني را نعمت گوسپند وگاو و شتر
و مانند این بود و نکته انکه نخست
مال را یاد کرد پس فرزندان آنست
کی فرزند و بالست و بمال فرزندان

Text of Tabary.

خدای تعالی بر ایشان یاد کرد گفت
وَاتَّقُوا الَّذِي أَمَدَّكُمْ بِمَا تَعْلَمُونَ أَمَدَّكُمْ
بِأَنْعَامٍ وَبَنِينَ وَجَنَّاتٍ وَعُيُونٍ إِنِّي
أَخَافُ عَلَيْكُمْ عَذَابَ يَوْمٍ عَظِيمٍ گفتا
بترسید ازان خدای که شما را ان داد
برین جهان از چهار پایان و فرزندان
و بوستانها و چشمهای آب و از بهران
چهار پایانرا یاد کرد خواستهٔ ایشان
در بیابان چهارپای بود از گاو گوسفند
واشتر و این برایشان گرامی بود
وحکمت اندرین آنست که نخستین
چهارپای را یاد کرد و باز خواسته که
بر مرد درسبز از فرزند نه بینی که مردم
نخست کسب خواسته آرزو کند پس
فرزندان پس هود علیه السلام ایشانرا
پنجاه سال بخدای تعالی همی خواند
وموعظة کرد وپند داد شان ایشان
جواب دادند و گفتند سَوَاءٌ عَلَيْنَا أَوَ
عَظْتَ أَمْ لَمْ تَكُنْ مِنَ الْوَاعِظِينَ
گفتند خواهي پند بده و خواهي
مده و ما بتو نخواهم گرویدن
چنانکه خدا تعالی گفت حکایة قَالُوا
يَا هُودُ مَا جِئْتَنَا بِبَيِّنَةٍ وَمَا نَحْنُ

Text of Ghazzály.

توان داشتن و گفتست اَلْمَالُ وَالْبَنُونَ
مال را پیش از فرزند یاد کرد ازانکه
مال بر خلق گرامي بود هود ایشانرا
پنجاه سال همي بخدای عز وجل مي
خواند و پند مي داد ویرا جواب دادند
سَوَاءٌ عَلَيْنَا أَوَعَظْتَ أَمْ لَمْ تَكُنْ مِنَ الْوَا
عِظِينَ گفتند خواهي پند ده وخواهي مده
همه یکیست کی بتو نخواهیم گرویدن
قوله تعالی قَالُوا يَا هُودُ مَا جِئْتَنَا بِبَيِّنَةٍ
وَمَا نَحْنُ بتارکی آلِهَتِنَا عَنْ قَوْلِكَ وَ
مَا نَحْنُ لَكَ بِمُؤْمِنِينَ گفتند ما را
همي گوئي کی این خدایان ما نه
خدایان اند و بدین حجت و درستي
نیاوردي و ما بگفتار تو این خدایانرا
دست بازنخواهم داشتن و بتو نخواهیم
گرویدن إِنْ نَقُولُ إِلَّا اعْتَرَاكَ بَعْضُ
آلِهَتِنَا بِسُوءٍ ما چنین دانیم کی تو
دیوانه شدهٔ و این خدایان ما کی تو
ایشان را نمی پرستي ترا دیوانه کرده
اند بس هود پنجاه سال ایشانرا
می خواند و کس بوی نگرویدند
و آنکه بگروید دین خویش پنهان
می داشت و آشکارا نیارست کردن

Text of Tabary.

بتَارِكِي آلِهَتِنَا وَمَا نَحْنُ لَكَ بِمُؤْمِنِينَ
گفتند یا هود مارا میگوئي که این
خدایان ما نه خدایند وبدین حجتی
درستي نیاوردي و ما به گفتار تو
نخواهیم ازین خدایان دست باز
داشتن وبه توگرویدن چنانکه خدای
تعالی گفت اِنْ نَقُولُ اِلاَّ اعْتَرَاكَ بَعْضُ
آلِهَتِنَا بِسُوْءٍ ایدون گویم که تو دیوانه
شدي واین خدایان ما ترا دیوانه
کردند پس پنجاه سال ایشانرا بخدای
تعالی خواند هیچ نگرویدند وانچه
بگرویدند دین خویش پنهان مي
داشتند پس چون روزگار بسیار برآمد
و هود علیه السلام نومید شد ازیشان
خدای تعالی خواست که ایشانرا
عذاب کند آن چشمهای آب همه
خشك شد و چهار پایان همه بمردند
وسه سال باران نیامد وقحط بر ایشان
افتاد وآن مردمان که بزمین شام و
حجاز بودند هرگاه که باران باز ایستادی
به زمین مکه آمدندی وانجا قربان
کردندی وخدای تعالی را خواندندی
هرچند که کافران بودند وخانه را اثر

Text of Ghazzály.

چون روزگاری بسیار برآمد و هود
از ایشان نومید شد و خدای تعالی
دانست کمي کس از ایشان نگرود
وخواست که ایشانرا عذاب کند ان
چشمهای ایشان خشك شد و چهار
پایان شان همه بمردند وسه سال شان
از آسمان باران نیامد وقحط برایشان
افگند وهرکجا از زمین شام کی چون
باران شان نیامدی سوی مکه آمدندی
و آنجا قربان کردندی و خدای
عزوجل را خواندندی هرچند کافر
بودندی وخانه را اثر بدید نبود کی
خانه از وقت طوفان نوح ناپدید بود
تاوقت ابراهیم علیه السلام کی ابراهیم
آن براورد ولیکن کافر آن همه می
دانستند کی این زمین مکه زمین
حرم است وشنیده بودند کی ایذا
خانه خدای آسمان است پیش
از طوفان بخبرها اندران حرم را بزرگ
داشتندی و هرکرا حاجتی بودی
دانستی کی این حاجت جزخدای آسمان
روانتواند کردن و چون بیمار را
عافیت خواستندی وچون کسی را

Text of Tabary.

پدید نبود و از وقت طوفان تازمان
ابراهیم علیه السلام ناپدید بود پس
این کافران همي دانستند که این
زمین مکه زمین حرم است وشنیده
بودند که انجا خانهٔ بود پیش از
طوفان وآن حرم را بزرگ داشتندی
و جایگاه حرم تا انگاه بالای او بود چون
کوه پاره بر دیگر جایها بلند و برج
و هر کرا حاجتي بودی که دانستی
که آن حاجت را جز خدای تعالی
روا نکند چون باران و فرزندان و از
دشمن فرح و از دوست راحت
برسرآن کوه خدای را بخواندندی
پس خدای تعالی حاجتهاي شان روا
کردی و علما و متکلمان ایدون گویند
که این از بهرآن بود که خدای تعالی
هرگز زمین بی حجت ندارد و خلق را
بغفلت اندرنه پسندید و بزمانه پیشین
از هود علیه السلام پیامبری نبود
که خلق را بخدای خواندی از حرم
راحت خویش کرد به زمین تا چون
این حاجتها شان همه روا شدی
و علامتها پدید آمدی بدانستندی

Text of Ghazzály.

اسیری بدست دشمن بودی وچون
ستمگار بودی کی با او خصم او بر
نیامدی بزمین مکه آمدندی و قربان
کردندی و برسرآن کوه خدای عزوجل
را بخواندندی و این از بهر آن بود
کی خدای تعالی زمین را بی حجت
ندارد و خلق را در غفلت نگذارد
و دران زمانه پیامبر نبود کی خلق
را راه نمودی حرم را حجت خویش
کرد بزمین تا چون این حاجتها شان
روان شدی و این علامتها بدیدندی
بدانستندی کی ایشانرا خدای هست
نه این بتان کی این کارها او همي کند
آن حجت خدای عز و جل بود برخلق
تا هریك بخدا عز وجل نگررد او را
حجت نبود و نتوانند گفتن کی من
نشناختم و ندانستم و نام خدای
تعالی نشنیدم بل کی حجت خدای
عز و جل را بود تا چون او را نپرستند
ایشانرا بدوزخ کند بحجت پس چون
کار برقوم عاد سخت شد گفتند مارسول
فرستیم بحرم و قربان فرستیم تا دعا
کند و مارا باران آید از آسمان یکی را

Text of Ghazzály.

فرستادند نام اولقمان و ازایشان
ببالا و بسال مهتر بود و بقوت و بعاد
بنسب نزدیکتر بود و لقمان بن لقیم
بن عاد بزرگ بود ودر نهان با هود
پیغامبر یکی بود ومردی دیگر نام او
مرثد بود بن سعد و بردین هود بود
وبدو گرویده بود آشکارا و هم مهتر
ایشان بود وهمدیگر مردی بود نام
او قیل وکافر بود وبا هود بتعصب بود
و متهر ایشان هرسه بود بس هرسه
تن را بفرستادند با چهار پایان بسیار
ازگوسپندان وگاو وشتر و گفتند این
چهار پایان را بمکه قربان کنید واز
خدای تعالی ما را باران خواهند
ومیان ایشان ومیان زمین مکه
سه روزه راه بود هود علیه السلام ایشانرا
گفت ای قوم بمن بگروید تا خدای
تعالی ما را باران دهد اگر باران خواهید
قوله تعالی اَسْتَغْفِرُوا رَبَّكُمْ ثُمَّ تُوبُوا
اَلَيْهِ يُمَتِّعْكُمْ مَتَاعاً حَسَناً وَيَزِدْكُم قُوَّةً
اَلَى قُوَّتِكُمْ بس سخن هود نشیدند
وآن سه کانه را بفرستادند تا بزمین
مکه آمدند وایشانرا بمکه خویشاوندان

Text of Tabary.

که ایشانرا آفرید کاری هست و این
بتان چیزی نیست و چیزی نتوانند
کرد واین حاجتها خدای تعالی
روا کند نه بتان آن حجت خدای بود
بر ایشان تا هرکه بر خدای عزوجل
نگروید اورا حجت نبود و نتواند گفتن
که من نشناختم خدایرا ندانستم چه
حجت بر ایشان بود واگر خدای را
نه پرستند وبدوزخ برد شان پس
گفت چون کار سخت شد برقوم عاد
وصلیت ندانستند گفتند یا رسول
فرستیم تا دعا و قربان کند تا باران
آید از آسمان وسه کس را اختیار کردند
از مهتران یکی را نام لقمان بن هذیل
و او از مهتران بود وبه نسب بعاد
نزدیکتر بود و با هود علیه السلام
گرویده بود و از مردمان پنهان همی
داشتی وآن دیگر مردی بود نا مش
مرثد بن سعد او نیز بر دین هود
علیه السلام بود وبوی آشکارا گرویده
بود وهم از مهتران ایشان بود وسویم
را نام قیل بن عمر وبن مرثد آنکه
بادشاه بود و کافر بود و با هود

Text of Tabary.

علیه السلام بتعصب بود و مهتر
ایشان بودم سه تن را بفرستادند با
چهار پایان بسیار از گاو و گوسفند
و اشتر و ایشانرا گفتند بشوید بمکه
و این قربانهارا آنجا بکشید و از خدای
آسمان مارا باران خواهید میان
ایشان و مکه سه روزه راه بود و هود
علیه السلام ایشانرا گفت یا قوم بمن
بگروید تا خدای تعالی شمارا باران
دهد چنانکه گفت اسْتَغْفِرُوا رَبَّكُمْ ثُمَّ
تُوبُوا إِلَيْهِ يُرْسِلِ السَّمَاءَ عَلَيْكُمْ مِدْرَارًا
وَيَزِدْكُمْ قُوَّةً إِلَى قُوَّتِكُمْ ایشان سخن
هود علیه السلام نشنیدند و این سه تن
را فرستادند و چون بیامدند به زمین
مکه ایشان را خویشان بودند هم از
قبیله عاد ازان گروه یکی معاویه
بن بکر بود ایشانرا فرود آوردند ومهمان
داشتند و دانستند که ایشان عاد اند
بباران خواستن آمده اند گفتند
سه روز مهمان باشید و آنکه بکار
خویش مشغول شوید گرامي کردند
ایشانرا و نبیند آوردند و کنیزکان
مغنیه و ایشان به بینند و مهمانی

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بردند از کوه معویه بن بکر ایشانرا
مهمان داري کردند و گفتند کی سه روز
برما مهمان باشید وانگاه بکارها مشغول
شوید وخوانها شان نهادند نبیند شان
دادند و کنیزکان مطرب آوردند وبمی
خوردن مشغول شدند یك ماه و از
قوم خویشتن شان یاد نیامد بعد از
یکماه این مهمان داران دانستند کی
ایشان بلهوه نبیند قوم خویش را
فراموش کرده اند و غم همي خوردند
کی آن قوم عاد هم خویشان ایشان
بودند و شرم داشتند کی ایشانرا از
خانهٔ خویش بیرون کنند و باز کار
فرستند آن کنیزکان مطرب را شعر
آموختند تا آنرا بلحن و سرود پیش
ایشان بگفتند گران یاد قوم و آنچ
بر ایشان می رود از تشنگي چون آن
قوم از مطربان حدیث قوم خویش
شنیدند از قوم خویش یاد آمد وگفتند
کی ما خطا کردیم کی قوم خویش را
فراموش کردیم برخاستند کی قربانها
ببرند اپن مرثد و لقمان کی بهود
گرویده بودند دین خویش را پیدا کردند

Text of Tabary.

خوردن مشغول شدند یکماه آنجا
بماندند وامروز بعرب اندر مثل زنند
هرجا که رسولی فرستند بکاری وآن
بکار خویش مشغول شود و اورا فرستد
یاد نکند او را وفد عاد گویند پس
چون یکماه ببودند میزبان دانست
که ایشانرا قوم خویش فراموش گشت
قوم عاد خویشاندان او بودند شرم
داشت که ایشان را از خانۀ خویش
بیرون ونا کاری فرستد که آمده اند
مرآن کنیزکان را که مغنیه بودند بیتی
چند شعر بگفت وآن کنیزکان را
بیاموخت تا درسرود بگفتند * شعر *
ایا قیل ویحك قم فهم لعل الله
سحبا سحابا * فیبقي ارض علینا
سحا فقد صارت دیارکم خرابا * فانت
عاد قومك یا بن عمرو عیب مذاک
لدکت اسکابا * فما هذا التهاون عن
مقام یرجي فیه قومك ان نجانا *
پس چون ایشان این بیتها بگفتند
بوی اندر حدیث عادگروه وآن سختي
و تشنگي که بر ایشان بود چون این
بشنیدند ایشانرا یاد آمد آنکه با

Text of Ghazzály.

و مرقیل را گفتند این یکی را که کافر
بود اگر قوم ما بهود بگرویدندی خود
ایشانرا باران آمدی و این قربانها
نبایستی قیل دانست کی ایشان بهود
گرویده بودند واز هلاک قوم پاک ندارند
ایشانرا بگذاشت و خود تنها برفت
و برسر کوه برشد کی جای قربانست
بکوه مني وآن قربانها بکشت وسر
سوی آسمان کرد و گفت ای خدای
آسمان تو داني کی من اینجا بحاجت
آمدم وحاجت من نه بیماریست کی
ورا شفا خواهم ونه اسیری کی راحتش
خواهم ولیکن باران خواهم قوم
خویش را کز تشنگي هلاک شدندی
ومیگفت ودعا همیکرد تا سه ابر
بر آمد وبهوا بایستاد یکی سپید ویکی
سرخ ویکی سیاه وآوازی ازهوا برآمد
کی ازین سه ابر کدام خواهي بگزین
تا بقوم تو شوند با خود گفت کی این
سپید دانم کی تهیست دروباران نبود
واین سرخ ندانم کی بمیان اوچه بود
وابرسیاه میان اوبارآن بود کی مارا
چون ابرسیاه آمدی ازوباران آمدی

Text of Tabary.

خویشتن بگفتند که ما خطا کردیم
قوم خویش را فراموش کردیم
برخواستند که قربانها ببرند لقمانؑ
و مرثد که با هود علیه السلام گرویده
بودند دین خویش را پیدا کردند و قیل
را گفتند که اگر قوم ما بهود علیه السلام
بگرویدندی ایشانرا باران آمدی
و این قربانها نبایستی و رنج آمدن
هم نبودی قیل چون این حدیث
از یشان بشنید خشم گرفت برایشان
مرثد ولقمان از پیش او برفتند تا
بکعبه فراز رسیدند مرثد دست بر
آسمان برداشت و گفت * شعر *
یارب یارب الجود و الماجد الفرد العلي
الواحد * ان ابن عمرو قد اتاك طالبا
مستعميا * ملك اليك داعيا بين
معشر * فرد حجاز هم بارزاق العباد *
تفسیر این بیتها بفارسي گوید ای
خدای دهنده و بزرگوار پسر عمرو از
برای تو آمد باران خواهنده از برای
قوم کافر حاجت او روا کن ای روزي
دهندهٔ بندگان پس چون او بگفت
لقمان برخاست و گفت بدعا * شعر *

Text of Ghazzály

بانگ کرد کی این ابر سیاه خواهم
کی بقوم من شود و دران ابر سیاه
باد عذاب بود خدای عز و جل فرشتگان
عذاب را فرمود تا آن ابر سیاه را بزمین
قوم عاد رانند وقیل از کوه فرود آمد
و سوی آن دوبار خویش رفت و گفت
کی ابر سیاه بر آمد با باران و بقوم
خویش فرستادم و با ایشان بشراب
نشست و آن ابر بقوم عاد رفت و بیش
ابر باد همي شد چون ابر سیاه نزدیك
ایشان رسید شادي کردند کی باد و
ابر بر آمد و باد ان قوله تعالى فَلَمَّا
رَأَوْهُ عَارِضًا مُسْتَقْبِلَ أَوْدِيَتِهِمْ قَالُوا هَذَا
عَارِضٌ مُمْطِرُنَا و هود می دانست کی
آن عذابست کی او را خدای تعالى
آگاه کرده بود ایشانرا گفت بَلْ هُوَ مَا
اسْتَعْجَلْتُمْ بِهِ رِيحٌ فِيهَا عَذَابٌ أَلِيمٌ پس
چون برابر سر ایشان رسید با یستاد
و آن باد عقیم از و بیرون آمد چنانکه
خدای عز و جل گفت وَفِي عَادٍ إِذْ
أَرْسَلْنَا عَلَيْهِمُ الرِّيحَ الْعَقِيمَ و عقیم
آن بود کی از و هیچ منفعت نبود و از
باد بدین جهان اندر منفعتهای بسیار

Text of Tabary.

یارب انی قدمن مصدق * و انت ربی
یهدی موفق * فمن یارب علی منا *
ان یحبس القطر ولانصا * بپارسی
چنین گوید که ای خدای راست گو
راه راست دهندهٔ من مومنیم و گفتار
تو خدای راست دارم منت کن برمن
که باران باز داری و ندهی پس بانگ
آمد که دعای شما نزدیك خدای
تعالی مستجاب شد پس ایشان بکناره
شدند و بخواستند که بادشاه ایشان
بداند که پیش از و بدعا آمدند بخلاف
آنکه او همی خواهد چون یکزمان
بود بادشاه آمد که نام او قیل بود و
کافر بود تنها برفت برسر کوه برشد
آنجا که جای قربانست بکوه مناوان
قربانها بکرد و باز آمد تا به کعبه
پس گفت * شعر * یارب قد جیت
مستعمیا فقد منذا بالذی و هیذا * من
شدم الاقحاط والثغوب فنالنا فی الناس
من حزبت فیما یلسا * عند امساك
المطر من الشد الحال مما ان مقرالا
الیک فاستقمنا * الغیاث حتی یعجم
الحزن والدمانا * بپارسی چنین گوید

Text of Ghazzály.

است کی درختانرا آب بریزد و میوها
بگیرد و کشتیهارا بدریا براند و بویهای
خوش بیارد و اب سردکند و برباذی
کی اندروازین معنی چیزی نبود آنرا
عقیم خوانند وجای دیگرعاتی خواند
قوله تعالی وَاَمَّا عَادٌ فَاُهْلِکُوْا بِرِیْحٍ
صَرْصَرٍ عَاتِیَةٍ وصرصر باد سرد بود
و عاتیه بی فرمان آنکه کس او را از
خویش نگاه نتواند داشتن بس هرج
ایشانرا چهار پای بود باد از زمین
بر گرفت و بر هوا برد و برزمین زد
و پاره پاره بکرد قوله تعالی مَا تَذَرُ مِنْ
شَیْءٍ اَتَتْ عَلَیْهِ اِلَّا جَعَلَتْهُ کَالرَّمِیْمِ
ورمیم آن استخوانها بود کی بر و سالها
گذشته باشد و باران بسیار برو برگذرد
چون بدست مالی همه خاک شود
پس چون ایشان آن هول بدیدند
گفتند صبر کنید کی از بس باد باران
بود از خانها بیرون آمدند و برسادهٔ
زمین پای فرو بردند تا ساق و بیستادند
بمردی و هود پنداشت کی بسوی
او آیند و خواهش خواهند و بخدای
عز وجل بگروند نگرویدند و باد اندرآمد

Text of Tabary.

که یاخدای ما باتو آمدیم باران خواهم
که مبتلا گشتیم با آنچه بما رسید از قحط
وکم بودن چهارپای واشتر و بهیچ
کس نتوانیم گریختن الا مارا تو بارانی
ارزانی دار و صحرا و هامون را ترکن و
مارا سیراب کن و سر بآسمان کرد و
گفت یا خدای تو دانی که من بحاجت
آمده ام حاجت من نه بیماریست که
عافیت خواهم ونه اسیریست که راحت
خواهم ولیکن باران خواهم مر قوم
خویش را که از گرسنگی هلاک شدند
وهمی دعا کرد تا سه ابر آمد و بهوا
اندر ایستاد یکی سپید ویکی سرخ ویکی
سیاه واو را از هوا بانگ آمد که ازین
سه ابر کدام خواهی بگزین تا بقوم تو
شود او بخویشتن اندیشه کرد و گفت که
این ابر سپید دانم که تهی بود وبمیان او
باران نه بود و این ابر سرخ ندانم
بمیانش چه بود و لیکن ابر سیاه را
باران بود که مارا چون باران آمدی
ابر سیاه آمدی ابر سیاه را بگزید وبانگ
کرد که این ابر سیاه خواهم که بقوم من
شود وبدان ابر سیاه اندر باد عذاب بود

Text of Ghazzály.

و هریکی را از زمین برگرفت و بهوا
بر برد و بزمین برزد وبکشت تا همه
را بکشت و هریکی را چند درختی
برزمین افکند قوله تعالی كَأَنَّهُمْ أَعْجَازُ
نَخْلٍ خَاوِيَةٍ گفت چون درختان خرما
کز زمین برکنی و بفکنی و الخاوية
الساقطة علی الارض خوی النجم اذا
سقط قوله تعالی كَأَنَّهُمْ أَعْجَازُ نَخْلٍ
مُنْقَعِرٍ و هرکه از یشان بگریخت باد
از پس او بشد و اورا نیز بر زمین
زد و بکشت و زنانرا نیز بخانها اندر
شد و ایشانرا از زمین بر می گرفت
وازین دیوار بدان دیوار می زد تا همه
را بکشت هفت شبانروز آن بادرا
بریشان مسلط کرد قوله تعالی سَخَّرَهَا
عَلَيْهِمْ سَبْعَ لَيَالٍ وَثَمَانِيَةَ أَيَّامٍ حُسُومًا
یعنی دایمه وهیچ کس از یشان نماند
مگر هود پیغامبر علیه السلام و آنکه
مومن شده بودند باد ایشانرا هیچ زیان
نکرد قوله تعالی فَلَمَّا جَاءَ أَمْرُنَا نَجَّيْنَا
هُودًا وَالَّذِينَ آمَنُوا مَعَهُ بِرَحْمَةٍ مِنَّا
وَنَجَّيْنَاهُمْ مِنْ عَذَابٍ غَلِيظٍ واین
وفد ایشان بمکه نشسته بودند هرسه

Text of Tabary.

خدای تعالی فرشتگان عذاب را فرمود
تا ابر سیاه را براندند و بزمین قوم
عاد بردند و قیل از کوه فرود آمد
بسوی یاران خویش و ایشانرا گفت
ابر سیاه پر باران فرستادم بسوی قوم
و بایشان بمی خوردن بنشست و این
ابر برفت بقوم عاد و باد پیش او همي شد
چون ابر نزدیک ایشان برسید شادي
کردند و گفتند باد آمد و ابر برآمد
و باران آمد چنانکه خدای تعالی گفت
فَلَمَّا رَأَوْهُ عَارِضًا مُسْتَقْبِلَ أَوْدِيَتِهِمْ قَالُوا
هَذَا عَارِضٌ مُمْطِرُنَا و هود علیه السلام
دانست که آن عذاب است که خدای
تعالی او را آگاه کرده بود و ایشانرا گفت
بَلْ هُوَ مَا اسْتَعْجَلْتُمْ بِهِ رِيحٌ فِيهَا عَذَابٌ
أَلِيمٌ چون ابر بر ایشان رسید بایستاد
و آن باد عظیم ازان جا بیرون آمد
چنانکه گفت وَفِي عَادٍ إِذْ أَرْسَلْنَا
عَلَيْهِمُ الرِّيحَ الْعَقِيمَ و عقیم آن بود که
ازو هیچ نفع نبود و از بادها بدین
جهان منفعتها است که درختان را
آب بر یزد و میوه ها بگیرد و کشتیها
بدریا اندر براند و بویهای خوش بیارد

Text of Ghazzály.

و همي خوردند و خبر نداشتند
تا مردی آمد بر شتری نشسته نه از قوم
عاد ولیکن بوادي عاد برگذشته بود
و آن بدیده بود ایشانرا خبر داد کی
همه خلق هلاک شدند مگر هود وانکه
بدو گرویده بودند این دو تن مومن
شاد گشتند و قیل کافر از بهر قوم
خویش اندوهگین شد برخاست و بر
کوه مني بر شد و ابن لقمان و مرثد
با او بر شدند و او را گفتند بهود بگرو
والا تو نیز هلاک شوي هم چنانکه
قوم عاد شدند او گفت مرا بس ایشان
زندگاني نیابد و سر درکرد وگفت ای
خدای آسمان اگر این سخن راست است
وقوم من هلاک شدند مرا نیز هلاک کن
بادی برآمد و ویرا از سر کوه برگرفت
و بر زمین زد و بکشت و این دو تن کی هود
ایمان آورده بودند ایشانرا از کوه آواز
آمد کی شما هرکسی چیزي بگزیند
خویشتن را تا بیابید مرثد بن سعد
گفت خواهم کی مرا گندم بود چندانی
کی تا زنده باشم نان گندمین خورم
او را اجابت آمد برفت و به مکه آمد

Text of Tabary.

و هر بادی که اندر وی منفعتها بود
اورا عقیم نگویند و عاتیه وصرصر که
باد های عذاب است و بر سر ایشان
بایستاد و هرچه ایشانرا چهار پای بود
از زمین برگرفت و بهوا برد و پاره پاره
کرد چنانکه خدای تعالی گفت مَا تَذَرُ
مِنْ شَيْءٍ أَتَتْ عَلَيْهِ إِلَّا جَعَلَتْهُ كَالرَّمِيمِ
ورمیم آن استخوانها بود که سالهای
بسیار برو برآید و سست و فرسوده شود
واگر بدست بمالي خاک شود و گفت
هر چیزی که آن باد بدو آمدی
چون خاك گردانیدی پس چون
ایشان هول آن باد بدیدند هریك
با دیگر گفتند صبر کنید که از پس
این باران بود پس از خانا ها بیرون
آمدند بر سادهٔ زمین و پای بر زمین
فرو بردند تا ساق و بایستادند و هود
علیه السلام ایدون پنداشت که سوي
وبزنهار آیند وخواهش کنند و بخدای
عز و جل بگروند از ین قوم هیچ
نگرویدند چون آفتاب فرو شد بادی
برخاست عظیم از میان دوکوه بزرگ
و هر زمان که برامد سخت تر بود

Text of Ghazzály.

ازان کوه وانجا بنشست تا بمرد ولقمان
گفت من عمر خواهم بسیار اورا آواز
آمد کی هرچند دیر تر زیي آخر هم
ببايد مرد گفت روا است گفت ترا باد
عمر هفت کرگس و نیز هم بمکه
بنشست و بر سر کوه بر شدی انجا
کی کرگس خایه کند و بچهٔ کرگس را
نگاه داشتی چون ازخایه بیرون آمدی
برگرفتی وبپروردی تا هفت کرگس
بپرورد باز بسین کرگسان لُبد نام بود
پس لقمان با لُبد هردو بیکجای
بمردند محمد جریر گفت کی هرگز
کسی هشتاد سال نزیست و بجز های
دیگر بیشتر گفتند کی بزیستي و هود
با آن مومنان بزمین عاد بماندند
از پس عاد پنجاه سال پس بمرد وعمر
او صد و پنجاه سال بود ونیز از پس
هود صد سال دیگر تا قوم صالح
وثمود واندران صد سال هیچ پیغامبر
نبود همهٔ ملوک بودند و هریکی را
دینی جدا بود یکی بت پرست
و یکی آتش پرست وهرگونه تا وقت
صالح علیه السلام *

Text of Tabary.

پس زنی از یشان که او را بهدوانی خواندندی بمیان منیع النهر نگریست تف آتش دیدند که زمانه همي زد آن زن بترسید و دست بر دست زد و اینکه اکنون کسی را محنتی رسد دست بردست زند ازان وقت باز ماند پس آن زن بانگ زد تا همه بزرگان نزدیك او آمدند و آن زن گفت * شعر * ان الذي فطر السماء نارا * انبشر من حرفها اثر زارها * فاستخروا بالرسول هود * نبي الرب الواحد المعبود * فقد آناكم عنفیر وایته * ولیس یبقي فیکم من باقیة * پارسي گوید ای مردمان من بمیان آسمان آتشی همي بینم درخشنده زد و باشید ودست بهود پیامبر زنید که شمارا عذابی همي آید وکاری بزرگ همه بدان هلاك شوند وهیچ کس نمانید هیچ کس بگفتاري او گوش نکردند وباد هریکی را بگرفت و بر هوا برد و بر زمین زد وبکشت وهریک ازیشان چون خرما بدان بدرازي افتاده بودند چنانکه مرده صد ساله وخدای تعالی گفت كَأَنَّهُمْ اعْجَازُ نَخْلٍ مُنْقَعِرٍ گفت چون بودند که درخت خرما را برکني وبیفگني تا آنهمه را اینچنین قد بود وهریك چون خرما بني افتاده و چنین گویند بدان هنگام که باد یک یک را بر زمین زدی درمیان ایشان یکی بود نام او خلجان بگریخت وبکوهی برشد واز دور همي دید که برباران او چه می رسد بازفراز آمد ازسرکوه وبنزدیك هود علیه السلام آمد هود علیه السلام گفت یا خلجان مسلمان شو تا برهي گفت یا هود مرا خدای تو چه دهد اگر مسلمان شوم هود علیه السلام گفت ترا بهشت دهد پس آنکه خلجان گفت چه بود که میان ابر چون اشتران بختي است هود علیه السلام گفت آن فرشتگانند خلجان گفت اگر من مسلمان شوم خدای تعالی مرا ایشان گرداند هود علیه السلام گفت آدمي را فرشته نگرداند گفت پس مسلمان نشوم همان ساعت بادي بیامد وبر هوا برد و به زمین زد

Text of Tabary.

وبكشت وانها که به خانها شدند ودرها بستند باد بخانها اندر شد و ایشانرا
از زمین برگرفت و بردیوار همي زد تا می مردند واین باد هفت شبانه
روز برایشان مسلط بود چنانکه خدای تعالی گفت كَذَّبَتْ ثَمُودُ وَعَادٌ بِالْقَارِعَةِ
فَأَمَّا ثَمُودُ فَأُهْلِكُوا بِرِيحٍ صَرْصَرٍ عَاتِيَةٍ سَخَّرَهَا عَلَيْهِمْ سَبْعَ لَيَالٍ وَثَمَانِيَةَ أَيَّامٍ
حُسُومًا فَتَرَى الْقَوْمَ فِيهَا صَرْعَى كَأَنَّهُمْ أَعْجَازُ نَخْلٍ خَاوِيَةٍ فَهَلْ تَرَى لَهُمْ
مِنْ بَاقِيَةٍ حسوما گفت یعنی دایمة وگفت عزوجل فَهَلْ تَرَى لَهُمْ مِنْ بَاقِيَةٍ
بیني که از ایشان کسی نماند مگر هود پیغامبر علیه السلام وانکسانی که
مومن بودند وبهود علیه السلام گرویده ایشانرا باد هیچ زیادتي نکرد چنانچه
گفت جل جلاله فَلَمَّا جَاءَ أَمْرُنَا نَجَّيْنَا هُودًا وَالَّذِينَ آمَنُوا مَعَهُ بِرَحْمَةٍ
مِنَّا وَنَجَّيْنَاهُمْ مِنْ عَذَابٍ غَلِيظٍ واین وقد ایشان بمکه نشسته بودند
وهرسه می میخوردند واگاهی نداشتند تا یکی مردی همي آمد براشتری
نشسته نه ازان قوم ولیکن بوادي عاد برگذشته بود با ایشان خبر آمد که
همه هلاک شدند مگر هود علیه السلام بدو گرویده بود پس آن دوتن که
مومن بودند لقمان ومرثد بمکه شادي کردند وسپاس داري مرخدای
را عزوجل کردند وآن دیگر که قیل بود دژم وغمگین نشسته بود از بهر
قوم خویش آن دوتن مومن گفتند که برسر کوه میدا بودند پیش قیل
آمدند وگفتند یا قیل از نسل عاد زندگاني نیابي قیل گفت یا خدای
آسمان اگر این سخن راست است وقوم من هلاک شد تو نیز مرا هلاک
کن پس همچنان بادی بیامد واورا ازسر کوه دربود و برزمین زد و
کشت لقمان و مرثد شکر خدای کردند عزوجل پس هود علیه السلام
ایشانرا آواز داد از انجا که بود و خدای تعالی آواز هود علیه السلام
بایشان رسانید وگفت شما هرکسی چیزی را بگزینید تا خدای تعالی
شما را بدهد مرثد گفت خواهم مرا گندم چنانکه تا باخر عمر مرا بس

Text of Tabary.

بود اجابت شد و بمکه رفت و انجا بود تا بمرد و لقمان گفت من درازي عمر میخواهم پس گفت اگرچند دیر بماني عاقبت بمیري گفت روا است پس خداي تعالی اورا زندگاني داد چنانکه هفت بادشاه بادشاهي کردند و بمردند و چنین گویند که کرگس را زندگاني دراز بود پس این لقمان بچه کرگس را بگرفتی و بداشتی پس کرگس آخررا که داشت نامش لبد برنهاد و هفتصد سال بزیست آن کرگس پس عرب گفتی بمثل که طَالَ الْأَمَدُ عَلَی لُبَدٍ پارسي چنین گوید که دراز شد مدتی زندگاني بر لبد و این لفظ مثل شد در عرب پس لقمان ولبد دریکروز بمردند و هود علیه السلام با مومنان اندر زمین عاد ببودند و از پس قوم عاد پنجاه سال دیگر بزیست و عمر هود علیه السلام صد و پنجاه سال بود تا وقت صالح علیه السلام و قوم ثمود همه ملکان بودند هرکسی بدیني جدا جدا آتش پرست و بت پرست و آفتاب پرست و هرگونه دینها بود تا وقت صالح علیه السلام *

* What follows is not found in Ghazzály.

و ابن عباس رضي الله عنه چنین گفت که ایزد تعالی باد صرصر را بمقدار فراخي انگشتري فرستاد که قوم عاد را هلاك کردند و اگر فزون تر بودی همه خلق هلاك شدی و دغفل چنین گوید یا علي بن ابیطالب رضي الله عنه نشسته بودم که پیری کهن سالی فراز آمد و بپرسید که امیرالمومنین کدام است گفتم اینکه روی را بعلي رضي الله عنه کرد و گفت * اسمع بکلامي هداک الله من هداک فا فرج بعملك من علت صادي * سمعت بالدین دین الحق یا بمحمد و هو بني الحضر و البادي * فدک علی القصد و اعلی الترتیب من خلدی بشرعة ذاة ایضاحتی و ارشاد * ان الهدایة بالایمان ناجیة عن العمرو النقي من خیل الراد * پارسي این بیتها چنین گوید که ای راه نمای راست بشنو و دلیل باش برحق تا شك از دل من بزوالي که

دين محمد صلى الله عليه وسلم حق است و بهترين دينها است اميرالمومنين
علي رضي الله عنه عجب ماند از شعر و فصاحت او پس گفت از كجائي
گفت از حضرموت پيش تو رغبت كردم تا مسلماني بياموزي علي رضي الله
عنه گفت ترا خداى تعالى توفيق دهاد هرچه تو ازو خواهي از من بيابي
پس او را گفت دانش تو چگونه است بدين كارها باحقاف رسيدى مرد
گفت از گور هود عليه السلام خواهي علي رضي الله عنه گفت كه بيان كن
آن مرد گفت كه من بوقت برنائي با گروهى از اهل بيت خويش بگور هود
عليه السلام رسيدم اشكاف درى با يست شدن سخت تنگ درميان كوه بركونهٔ
سروآبه مطبق بدو سنگ بزرگ آنجا يكى خانه چهار سو كنده بود و چهل
ارش بدان خانه اندر يكى تخت نهاده از رخام دراز و فراخ هود عليه السلام را
برآنجا خوابانيده دست بدو فراز كرد تازه ايستاده بود برمثال زنده و
برسر آن لوح نهاده بود از رخام و آنجا نوشته بود كه باسْمِكَ اللّٰهُ الْعَلِيِّ وَأَنَا
هُودُ النَّبِيُّ رَسُولُ رَبِّ الْعِبَادِ إِلَى الْمَلَإِ عَادٍ فَدَعَوْتُهُمْ إِلَى الْإِيمَانِ وَخَلْعِ الْأَنْدَادِ
وَالْأَوْثَانِ هَلَكُوا بِرِيحِ الْعَقِيمِ فَأَصْبَحُوا كَالرَّمِيمِ بپارسي چنين است كه بنام
خداى بزرگوار من هود پيامبرم بقوم عاد وايشان را بايمان خواندم تا
ازبت پرستيدن باز دارم فرمان من نبردند همه بباد عقيم هلاك شدند علي رضي
الله عنه گفت صدقت راست همي گوئي و فرمود تا او را سورهٔ چند از قران
بيا موزند و بسيار هديه داد چنين گويد دغفل كه چون قوم عاد را هلاك برآمد
بزمين يمن مرا كسان بودند كه بهود عليه السلام بگرويده بودند كه بحضر
موت بودند چون يعرب بن قحطان بن عابر بن شالخ بن ارفخشد بن سام
بن نوح عليه السلام برادران خويش را گرد كرد و همه از يك مادر بودند مادر
شان از قوم عاد بود بدان سبب همه تازي بودند و مهترين ايشان يعرب
بود پس جرهم و لقمان و ملتمس و عاصم و قطاى و عاصيب همه بدست
گرفتند و پيشين همه يعرب بود پس قحطان كه آنجا رسيد همي بود *

PROCEEDINGS

OF THE

ASIATIC SOCIETY OF BENGAL,

FOR SEPTEMBER, 1848.

The usual monthly meeting of the Asiatic Society was held at the Society's house on Wednesday evening, 6th September.

The Hon. J. W. COLVILE, *President*, in the Chair.

The proceedings of the last meeting were read.

The accounts and vouchers for August were submitted.

Baboo Gobindchundra Sen and C. Thornhill, Esq. having been duly proposed and seconded at the August meeting, were ballotted for and elected members of the Society.

The following gentlemen were named as Candidates for election to be ballotted for at the October meeting.

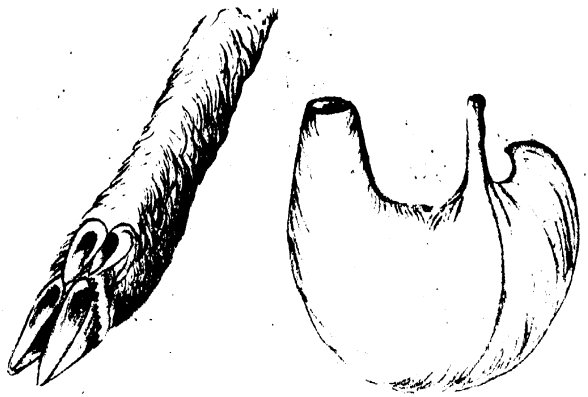
Capt. Pakenham, Body Guard, *Capt. Powel*, Ship "Precursor," proposed by Mr. Frith, seconded by Mr. Laidlay.

Capt. Banks, proposed by W. Taylor, Esq. seconded by G. A. Bushby, Esq.

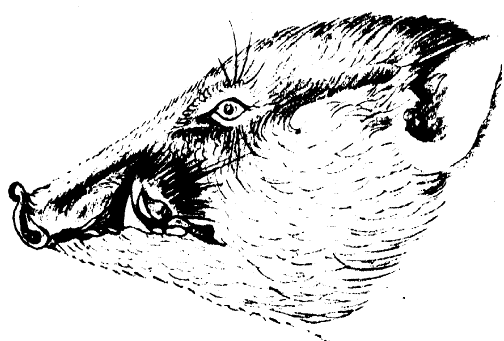
Lieut. F. W. Stubbs, Artillery, proposed by Lieut. Staples, seconded by Mr. Laidlay.

Read letters—

From G. A. Bushby, Esq. Secy. to Govt. of India, Home Dept. regarding the past and future application of the grant for Oriental Publications.



Foot, Stomach, and Head of the Pigmy Hog.



Porcula Salvania.

Home Department.—No. 685.

From G. A. Bushby, Esq., *Secretary to the Government of India,*
To W. B. O'Shaughnessy, Esq. Secretary to the Asiatic Society, dated the 29th July, 1848.

Sir,—With reference to my letters Nos. 240 and 247, dated 24th April 1847, I am directed by the Governor General in Council to inform the Asiatic Society that the Hon'ble the Court of Directors, in a Dispatch recently received, have authorized the grant to the Society of the privilege of drawing upon the Company's Dispensary for monthly supplies of spirits of wine not exceeding ten Gallons, on the understanding that a part of it will be applied in preparing specimens of Natural History for transmission to the Museum at the East India House.

2. The Hon'ble the Court of Directors have also sanctioned the remission of the demand to which the Society has become liable by the misapplication of the Government grant of 500 Rs. per. mensem for the publication of Standard Oriental works; and have authorized the continuance of the allowance, on condition that it be scrupulously applied to the collection and publication of Oriental works of interest and utility, an annual account being furnished to the Government of the appropriation of the sums received. I am accordingly directed to request that such accounts may be regularly furnished in future, and that a Statement be submitted of the appropriation of the sums received by the Society since April 1847, when the misapplication of the allowance was brought to notice.

3. With reference to the employment of this grant in the publication of the Vedas, you will be pleased to inform the Society that the Hon'ble Court have sanctioned the printing of the Rik Veda in England. It will therefore not be necessary to undertake the publication of that work in Calcutta. There are, however, other Vedas or portions of them which it is desirable to preserve through the means of the press, and which may very properly become the objects of the Society's attention.

I have the honor to be, Sir,
Your most obedient Servant,
G. A. Bushby,
Secretary to the Government of India.

Council Chamber,
The 29th July, 1848.

From W. Seton Karr, Esq. Under Secy. to Govt. of Bengal, forwarding a communication from Mr. Robinson, on the languages spoken by the Tribes inhabiting the valley of Asam and its confines.

Referred to the Oriental Section.

From H. M. Elliot, Esq. Secy. to Govt. of India, Foreign Dept. forwarding a narrative by Capt. Reynolds of our former relations with the Densarie Garrows.

From Capt. Thuillier, Officiating Deputy Surveyor General, forwarding Meteorological Register for August.

Communications were received and presented;—

From Dr. Aloys Sprenger, through H. M. Elliot, Esq. a Notice on Tabary and on an Historical work of Ghazzály.

From Prince Gholam Mohamed, presenting 2 copies of a Persian work, and 2 of English Memoirs of his grandfather and father, Hyder Ali Khan and Tippoo Sultan.

From H. Cuming, Esq. acknowledging the receipt of a bill of exchange for £25 10*s.* and requesting to know whether he is to continue to forward the Conchological Works of which portions had been sent to the Society. (To be referred to the Section of Natural History.)

From M. Eugene Burnouf, dated Paris, 10th January, regarding the edition of the Vedas now publishing by the Society.

From Lieut R. Maclagan, Principal of the Poostu College, forwarding some fragments of the History of Moultan.

From Messrs. Allen & Co. announcing shipment of the stock of copies of the Researches—also volumes of the Mahabharat and Mega. The expense amounting to £31 7*s.*

From Lieut. J. Strachey, forwarding two papers to be printed with his brother's Journal on the height of places in his route and on the construction of the map.

On the disposal of the business of the evening, Mr. H. M Elliot, V. P. after adverting to the heavy loss the Society had sustained by the death of Brigadier Stacy, so eminently distinguished for his antiquarian zeal, proposed the following resolution which was seconded by Mr. Laidlay, and carried unanimously.

"That the Society testify their respect for the memory of Brigadier Stacy, C. B., one of their most distinguished and liberal contributors, by entering upon record, their regret at the loss they have experienced by his death; and that this resolution be communicated by the Secretary to the surviving members of his family."

JOURNAL

OF THE

ASIATIC SOCIETY.

NOVEMBER, 1848.

Anatomy of Ailurus, Porcula, and Stylocerus, in continuation, with sundry miscellaneous emendatory Notes. By B. H. HODGSON, *Esq.*

In presenting to the Asiatic Society of Bengal my paper on the structure and habits of Ailurus, I noticed the circumstances which had tended to render my account of the anatomy less full and satisfactory than I could have wished, and I promised to take the first fresh opportunity to rectify and complete that account. I now proceed to redeem my pledge so far as my materials and the very frail state of my health have allowed me so to do. Last month I obtained a couple of young Wáhs alive. They were taken from the nest, a perforation in the bole of a lofty decayed tree, and were about half grown, male and female, alike in every respect of size and colours. They must have been born in April or May, and were certainly six months old when I got them. Yet they had not quitted the retreat in which they were born, nor had their mother ceased to tend them; whence we may safely infer that the period of infantine helplessness is much protracted in these most singular animals. So long as they lived they were fed with milk, or milk and rice. But they died in about 15 days under the terrible process of cutting the molar teeth. Each was from 12 to 13 inches long between the snout and anus. Testes of male in the groin, that is void of scrotum. Penis small, sheathed, directed forwards and downwards, and upon the whole assimilated to the same organ in Felis and Viverra, rather than in Canis or Paradoxurus,* though void of all semblance of

* Paradoxurus differs greatly from the Felines and Viverrines in the canine character of this organ, which is large and plainly directed, in its sheath, along the abdo- [illegible]

preputial sac or gland, and lastly, furnished with a small simple bone. Teats of female 8. Her vulva simple, that is, without trace of preputial gland. Anus of both with a large nude margin, but no appearance whatever of special anal glands, and no other semblance of pores than two very shallow simple reduplications of the skin, having a central lateral position (one on each side), probable only subservient to the lubrication of the parts. Peroneum of both sexes hairy and void of all trace of glands.

Ailurus ochraceus. Soft anatomy.—Male 12½ inches long from snout to anus. The male's thoracic and abdominal viscera are as follows:— The lungs have 4 main and 6 total divisions, and are disposed bilaterally on each side the œsophagus. The liver has 3 main divisions, that is, the laterals and the central. Of these the laterals are bifid, and the central, trifid, and there is no lobulus, so that the total divisions are 7. The lateral lobes are the larger and are very unequally divided. The gall-bladder is half imbedded in one of the clefts of the central lobe, and is of an elliptic shape, pouring its thin yellowish bile into the intestine about two inches below the stomach by one long clear duct. The pancreas is a very fragile, colourless, glandular, linguiform organ lying parallel to the biliary duct and close in contact with it. I could not satisfactorily trace the pancreatic ducts; but there seemed to me to be one, very short, put off from the lower or posteal end of the organ, and entering the intestine close to the entrance of the biliary duct, perhaps ¼ inch above it. Spleen 3 inches long by two, dark-coloured as a gizzard, tongue-shaped, and lying along the greater arch of the stomach with merely membranous attachments thereto. Heart 1½ inch long by 1¼ of greatest diameter, muscular and firm. Stomach pyriform, inclining to hemispherical and decidedly of the solvent type, though its outer coat shows some faint signs of muscularity upon the surface of its equable, thickish and membranous walls. Inner coat of uniform surface, void of folds or bands. Orifaces nearly but not quite terminal. Greater arch of the stomach 7½ inches; lesser, 2 inches. Towards the pyloric orifice is a sort of subsidiary stomach, extremely glandular and resembling in character but not in position the succenturiate ventriculus of

men. The special secretory glands are preputial and form a parallelogramic nude subvalvular field, in the centre of which lies the large membrum. In the female the lips of the vulva are the seat of the glands.

birds and of some few mammals. It has longitudinal bands along the inner surface and is very thick-coated. Intestines about 4¾ lengths of the animal, that is, somewhat shorter than in maturity; 4. 10½ long, of large equable diameter, void of cœcum, and exhibiting on their inner surface nor valves, nor folds, nor other retardatory processes, not even, I think, a valvula coli to distinguish the small from the great intestine. And, in fact, no such distinction has place, the intestinal canal being of equal breadth throughout and similar aspect internally,* save the last 6 inches, which are wider, thicker-coated and furnished internally with longitudinal bands, not unlike the post ventricle above noticed.

Kidneys 1 inch long, elliptic and lobulated, there being 3-4 distinct divisions of the body of the organ under the strong and uniform cortical substance or cover.

Soft anatomy. (*Female.*) The liver has 7 divisions in all; the right and left lobes about equal and bifid, but very unequally so; the central lobe, smaller and trifid.

The elliptic gall-bladder is freely suspended between the larger 2 lobules of the central lobe and discharges the bile into the intestine by a large clear duct about 2 inches long, and which enters the intestine about that distance from the stomach. The lungs have 4 chief divisions, but 6 in all, the 2 latter being very subordinate. The spleen is dark-coloured, tongue-shaped, and lies along the stomach longitudinally and centrally on its outer arch. The pancreas, in form, structure, and position as noted in the male, seems to discharge the pancreatic juice into the intestine just below where the bile enters it. The intestines are 4. 9½, of one equable diameter of half an inch, and void of cœcum or valves internally. The stomach is a large, membranous and simple sack, showing something of muscularity without, but no folds or bands of any sort within. I could not satisfactorily determine the form of the uterus in this young subject.

Hard anatomy. (*Male.*) Cervical vertebræ 7, dorsal and ribs 15, lumbar 5, sacral 3, caudal 18.† Total 48. Carpal bones 7, metacar-

* This remark refers to salient retardatory, and not to minute secretory, processes (villi) characterising the inner surfaces of various intestines.

† I have some doubt as to the number of sacral and caudal vertebræ, because the former are not clearly distinguished from the proximate vertebræ by any of the usual signs of anchylosis, depression, &c. The circumstances which have determined

pal 5, digital 3, for each digit, fore and aft, save the innermost, which has but 2. Tarsal 7, exclusive of the os calcis. Metatarsal 5. Digits 5, before and behind, with very free action on each other, and the so called thumb not much removed from the front, and of course not at all opposeable, being articulated in the same plane with the rest of the digits.

The alæ of the atlas and falciform process of the axis are small, and so also are the spinous and transverse processes of the vertebræ generally. The pelvis is short, broad and obliquely deflected from the plane of the spinal column. It is feeble too, owing chiefly however to the very imperfect anchylosis or osseous blending of the vertebræ of the sacrum. The bones of the pelvis in front (ossa pubis) are united merely by cartilage and form a short bridge of which the keystone is wanting. The ribs, of which 8 only, I think, are true and 7 false, are much curved or bulged; and this, with the large flat muscles laid over them, gives an ursine breadth to the chest, despite the narrowness of the sternum. The sternum is long, and consists of 7 bony cylindric pieces very distinctly articulated and having a very small ensiform cartilage. Admirable a climber as is the Ailurus, it has no clavicle, nor even pseudo-clavicle or os-claviculare; and as I have noticed the same thing in other eminently scansorial subplantigrades, I am rather surprised at the unqualified terms in which recent and eminent anatomists* express themselves on the subject.

The scapula is a stout broad triangular bone, but somewhat rounded along the superior elongate margin. Its glenoid cavity is rounded but inclines to an ovoid rather than a strictly special form. It is deep enough to afford secure lodgment to the condyle of the humerus, but not so deep as to interfere with free motion of the fore limb. The keel

me in regard to the joints constituting the sacrum are, distinct enclosure between the pelvic bones (ilia) and the openings for the passage of the nerves. In regard to the coccygeal vertebræ an envious rat, which ate off 3 or 4 of the vertebræ before I had completed my examination, but not before I had roughly counted all the joints of the spinal column, is the cause of my doubt.

* Lawrence and Coulson apud Blumenbach. Manual, Eng. Edit. of 1827, p. 49. Carpenter is more guarded. An. Physiol. p. 469. And Bell, The Hand, p. 46. It is possible I may have overlooked a very small os claviculare. And it is difficult to decide whether what I have assumed to be the metacarpal bone of the thumb be not rather the first phalanx.

of the scapula is strongly developed, and at its anteal extremity terminates in a cylindric process which advances as far forwards as the foremost part of the scapula, and appears designed to prevent dislocation of the shoulder in climbing when there is a violent outward pressure on the shoulder-joint. The acromion and coracoid are very slightly developed. The humerus is a single, stout, cylindric bone, as long as the radius and furnished with very large articulating surfaces at each end, especially the lower, towards which the strong ridge for the attachment of the supinators is conspicuous. The radius and ulna are quite separate, nearly equal in size and strength, cylindrico-depressed, with very ample and perfect articulating surfaces. The olecranon is small, like the os-calcis. The carpal bones are beautifully jointed so as to allow the freest motion to the wrists; and the digits play with the greatest freedom on one another. The talons or claws, fore and aft, are very highly curved, and much compressed. They have deep bases which are suddenly contracted forwards where they are grooved underneath. Their points are very sharp, and they can be turned over the penultimate phalanges as completely as in Felis, but they are only partially sheathed. The femur is as long as the tibia, a single, stout, cylindric bone, very similar in size and form to the humerus, and like it, distinguished by its enlargement at the distad end suited to afford room for the finest jointure. At its proximate or upper end is a very distinct neck, oblique to the shaft, as in the human subject, only thicker and shorter perhaps; and the ball and socket-joint whereby it is united to the pelvis is not so deep as in man, so that the leg has much freer motion, very similar indeed to that of the arm, wherein however the glenoid is not so round or so deep. The tibia and fibula are completely separate; the former stout; the latter, feeble, but both entering into the composition of the ankle-joint and both cylindric in form. The tarsus is as finely articulated as the carpus and the posteal digits have as free play as the anteal, both being quite alike in size and shape. The above details of the skeleton of Ailurus exhibit more conformity with the Plantigrade than with the Digitigrade model, except in regard to the talons, which are thoroughly feline or musteline. The separation of the ossa pubis* appears to be a

*** It is possibly only an effect of non-age. The interval of the bones is very narrow. So short is the pubic bridge that it appears to run as much transversely as longitudinally.**

remarkable character of Ailurus associating it, quoad hoc, with the Marsupials. Blumenbach (Man: pp. 46 and 53) and after him all others have noticed the length of the humerus and femur as a special character of the Plantigrades, and particularly of Ursus, their type. Quoad locomotive organs, Ailurus is very decidedly framed on the plantigrade model. Nor will it fail to be remarked how decidedly the small feeble processes of the cervical vertebræ in Ailurus sunder it from the Carnivora par excellence. Yet Ailurus has *their* talons and even *their* nutritive viscera, whilst its masticatory organs are of a diametrically opposite character. Such is the ænigma we are contemplating, which, however, may be thus far explained that if width of gut be allowed to be equivalent to* length, the extreme breadth of the intestines of Ailurus will bring them into harmonious correspondence with its triturant dentition. And we may always rest assured that there are no real anomalies in nature, how surprising soever, and at first not wholly intelligible to us that rich variety of means by which the same end is accomplished without violation of a given model of organization. But the state of my health warns me not to prolong these comparative remarks, which will be better made by others. I proceed therefore to my next subject, the Pigmy Hog of the Saul forest, an apparent second species of which form I have recently discovered in the Sus-Papuensis† of New Zealand. Since my account of that most rare and interesting animal, the Pigmy Hog, was submitted to the Society, I have been so fortunate as to obtain another and complete specimen of an old male. He was sent to me alive from the Saul forest, but died on his way up, and though the entrails thus became considerably corrupted before the examination took place, there was no destruction of parts, nor any thing to impede a just appreciation of the structure of the soft as well as hard anatomy. To enable me the better to appreciate the structure and affinities of the Pigmy Hog, I procured and dissected at the same time a sample of the ordinary domestic hog of this place, which is native to the Tarai though imported largely into the mountains, to satisfy the appetites of the lazy and carnivorous mountaineers.

Porcula Salvania. Soft Anatomy. A fine mature male. Length

* Blum. Man. p. 112. In the mature Ailurus the width of the intestines is one inch.

† Voyage de la Coquille, as quoted in the Penny Magazine, voce Sus.

from snout to vent 26 inches. Colour a clear amber brown. Pelage ample, ordinary. No mane. A strongly marked mystaceal tuft. Testes and penis as in Sus, but only 6 mammæ, which are clearly developed in the male, and are much more remote from each other than in Sus, the type of which has 12 teats. Liver 2 lobes, each sub-divided into 2, and no lobulus? 4 divisions in all. Gall-bladder half embedded in the great cleft, $1\frac{3}{4}$ inch long by $\frac{7}{8}$ wide. Biliary duct 3 inches, discharging the secretion into the nutritive canal close to the pyloric oriface of the stomach, so that the bile seems rather to pass into the stomach itself than into the intestine. Lungs 7 divisions in all, and more nearly equal in size (as are the lobes of the liver) than in Sus, but otherwise similar. Heart $2\frac{3}{8}$ inches by 2 of maximum width. Spleen very long and narrow like a Manis' tongue, $6\frac{1}{2}$ inches by $\frac{3}{4}$ inch. Position and general character as in Sus, but the organ is very decidedly longer and narrower in Porcula than in Sus. Pancreas too much decayed for examination. Stomach $10\frac{1}{2}$ inches along the greater arch, 3 inches along the lesser, in shape like the segment of a circle or crescent, longer and narrower than in Sus, and having a fundus in every respect of length and width much less considerable than in Sus. The orifices are more remote than in Sus; and the fundus, which contracts teatwise and is curved like a ram's horn towards the œsophageal canal, almost touches the cardiac orifice, partly by reason of this incurvation and partly because of the nearly terminal position of the upper orifice. Otherwise the stomach has the usual characters of Sus; but it is perhaps thicker in the coats. Great intestine 9 feet long and $1\frac{3}{4}$ inch wide, singly and slightly banded and sacced, whereas the same intestine in Sus is doubly and strongly banded and sacced. Cœcum $4\frac{3}{4}$ inches by 2 inches, conoid, not sacculated at all. In Sus the cœcum is banded and sacculated like the colon, and is also much more capacious than the plain cœcum of Porcula. Lesser intestines $14\frac{1}{2}$ feet long and $\frac{3}{4}$ inch wide.

To summarize the differences in the chylopoietic viscera of Sus and of Porcula, we may note that in Porcula the stomach is narrower, has the orifices more terminal, and altogether is of a much less retardatory character in regard to the passage of the food; that the great intestines and cœcum of Porcula uphold the same character of diminished retardation, the cœcum being less in size and void of sacculæ, whilst the colon is only singly and slightly sacculated, not doubly and strongly as in

Sus; that the intestines are shorter* in Porcula and more equally divided into great and small gut, thus yet further continuing the character of diminished retardation of the passage of the food; that the lobes of the lungs and liver of Porcula show less disparity of relative size and that its liver has apparently one lobule less than in Sus; that the spleen is much longer and narrower in Porcula; and lastly, that this Lilliputian member of the Suidæ or Hog kind has invariably six remote, instead of twelve proximate, teats.

Pigmy hog. Osteology. The cervical vertebræ are 5, the dorsal and ribs 14, the lumbar 6, the sacral 5, the caudal 10. Total 40. All these bones bear in general a resemblance to those of Sus, both as to number and character, the only material difference being the extraordinary diminution of the caudal vertebræ, which are 10 in Porcula, 20 in Sus. The sculls of the two with the same general characters, have two important disparities, to wit, that the length of the facial portion of the cranium is greatly contracted in Porcula, which likewise wants the characteristic and normal nasal bone of Sus. It should further be remarked of the scull of Porcula that in consequence of the diminished length of the face the molar teeth are carried much more backwards than in Sus. The extremities of the two types have characters too similar to make it worth while to enumerate the bones of the legs and feet in Porcula, which however differs from Sus, and approaches the Peccaries by the unusually diminished size of the inner back digit.

It will be seen above that I have assigned 5 cervical vertebræ to Porcula, and by implication, to Sus also. Both in fact are so characterised beyond all possibility of doubt, and I call attention to the facts with reference to the unqualified language of the most eminent Anatomists and Physiologists† to a contrary effect. Thus Doctor Carpen-

* As compared with the tame, but perhaps not as compared with the wild, hog. Porcula has 10 lengths for the intestines, great and small; and so also has the wild Boar, though the tame Pig has 13 and 14 lengths. (Blumenbach's Manual, page 114.) Some other differences may be resolved in the same way: but other and material ones, not.

† Blumenbach, Cuvier, Laurence, Coulson, Carpenter. (Manual, p. 42. Animal Physiology, p. 461.)

Cuvier makes one exception to the otherwise universal 7 cervical vertebræ among the Mammalia. His exception is the 3-toed sloth. (Leçons d'Anatomie comparée, I. 154.)

ter in his very recent work of 1844, "It is remarkable that the number of the cervical vertebræ should be the same in *all Mammals*, the long necked Giraffe and the seemingly neckless whale having each 7 vertebræ, like all the rest."

I cannot lay my hands upon any osteological formula for Sus, and I am aware that the tame breeds of the Pig manifest a strange variability in regard to some parts of their osseous frame-work. But I believe such deviations do not belong to the vertebræ of the neck in Sus, and upon the whole I think that the citations and quotation I have given will fully justify my having called special notice to the 5 vertebræ in the neck of Porcula, a perfectly and exclusively wild type.

I now proceed to the Stilthorns or Muntjacs.

Stylocerus Ratwa. Soft anatomy and cuticular organs. Young male, procured in April, died in October. Two-thirds grown yet not the least sign of horns. Small knobs as in the female in lieu of horns. Eye-pits large. Mufle large. Facial creases conspicuous, and their glands developed. Feet-pits in the hind extremities only, but there conspicuous. Inguinal pits none. No calcic gland nor tuft. Canines distinct but not yet exserted from the lips. Mamma 4. Liver with one grand lobe very partially divided, and a second small lobe. Gall-bladder none. Lungs with a primary dichotomous division. Right lobe quadripartite; left, tripartite and a lobulus. Spleen round, flat, attached to outer side of paunch. Pancreas tongue-shaped, narrow, pale; its ducts vague and doubtful. 4 stomachs a l'ordinaire. Great gut 10. 10. 0. First foot, or that next the cœcum, as wide nearly as it, or 2 inches. Cœcum 13 inches by $2\frac{3}{4}$, void of sacculation and banding. Small gut 41. 0. 0. very narrow, the average width being half an inch.

Osteology (from a mature specimen). The vertebræ of the spinal column are as follows: Cervical 7. Dorsal 13. Lumbar 7. Sacral 5. Caudal 13—14. Total 45-6. The sternum consists of 7 bones, which are broad and flat, except the first and last, and these are narrow and cylindric. Ribs 13, whereof 8 are true and 5 false. The ribs are compressed, or very little bulged laterally, and the chest exhibits the perfection of the "thorax carinatus" type, whence one is rather surprised at the breadth and flatness of the sternal plates; the very reverse moreover (to add to the riddle) being equally true of the broad-chested climbing Wáh! Ensiform cartilage of the sternum large and

spatulate. Reverting to the spinal column we note that the vertical and lateral processes of the cervical vertebræ are very inconspicuous, while the spinous processes of the dorsals are of perfectly uniform and very inconsiderable height. These are interesting points, having such harmonious and direct reference to the short neck and light head and horns of the Mantjacs. The processes of the lumbar vertebræ, on the other hand, are well developed; the spinous chiefly in depth (fore and aft), and the transverse in length. The spines of the lumbar and dorsal vertebræ are about equal in height. The vertebræ of the neck and back, possess extreme mobility. The sacrals are anchylosed, and have but small vertical or lateral processes. The ilia of the pelvis are united to the first, and first only, of the sacral vertebræ. The pelvis has the usual characters of elongation parallel to the spine in all its parts, even the symphysis pubis or pubic bridge being perfectly longitudinal and not less than $1\frac{3}{4}$ inch in extent. The bones of the extremities have the ordinary number and character with one signal exception, to wit, that the humerus and femur* are nearly as long as the radius and tibia, the length of the metacarpus and metatarus being I think proportionally diminished. To those who are conversant with Anatomy this elongation of the 1st joint of the legs will seem strange, and the more so when I add that the whole bones of the forelimb of the Ratwa are so far from any approach to perpendicularity or rigidity† that they are signally remarkable, even among Cervines, for the opposite characters. The fact is that the Ratwa has no powers of sustained speed or extensive leap: but it is unmatched for the facility with which it passes unscathed and delayed under that low, tangled and rigid undergrowth of the forest which forms its constant abode. I have seen the Ratwa often chased to death in an hour by a couple of the rude bowmen of these hills, aided by 3 or 4 chiens de rue. And on the other hand, I have, whilst stalking the Ratwa, myself been constantly foiled and amazed by the rapidity with which the creatures would glide out of sight and reach amid dense thickets of bamboo by a succession of

* Length of humerus $4\frac{3}{8}$ inches, of radius $4\frac{9}{16}$ inches, of femur $5\frac{3}{4}$ inches, of tibia $6\frac{1}{16}$ inches.

† See Bell's fine remarks on the rationale of the structure of the limbs in fleet quadrupeds, and especially of their fore extremities. (*Treatise on the Hand*, p. 54, et alibi.)

rapid bendings of the spine and limbs that enable them to wend on their way without kneeling or a moment's pause, where there were scarcely six inches of free perpendicular passage room. It is no, their speed, a quality of which they have little, but this weasel-like flexibility of the spine and limbs that enables the Ratwas, amid the peculiar copse-wood they inhabit, to foil their great enemy the wild dog or Cyon primævus. The Mantjacs of the genus Stylocerus or Stilthorn, though strictly Cervine animals, are no doubt the most aberrant of their family; and the singular habits I have just remarked on may serve, in part at least, as a key to the apparent anomalies, but real adaptations, of the Cervine model of structure as seen in them. Who, for instance, that has observed the Ratwa, whether at rest or in motion, has failed to remark the invariable and extreme low carriage of the neck and head? Now this I apprehend is as clearly referable to the length of humerus, which protrudes and depresses those parts, as it is perfectly suitable to the exigencies of the animal's position and its consequent comfort and safety.

I solicit the particular attention of those who have perused my Essay of the Ruminants of India (Journal, No. 180) to the following emendata et addenda. Character of the Cervidæ,—add Gall bladder wanting. Genus Rucervus, for type C. Elaphoides vel Duvaucelli, read Types C. Elaphoides et Duvaucelli. Captain Hutton assures me I may safely recur to my old notion that these two species are not identical, for that he possesses live samples of both. I conjecture that Mr. Gray's C. Smithii is but a synonyme of Duvaucelli verus. Genus Procervus; I have procured another specimen of this very rare animal, but alack! the horns were cast. It was a male and mature, and had no interdigital pits. Nor had the original specimen, nor my description of it, though the corrector of the press was pleased to make me say otherwise in print.*

Genus Rusa, for Feet-pits in all 4 feet, read Feet-pits none? Two recent specimens of the Jarai show no foot pores, and Captain Hutton assures me that his samples are similarly characterised. Wherefore I must presume mistake in my Nipalese memoranda, a portion only of

* See Vol. XVII., page 690, line 2. The expression there is "*Feet-pits none.*" —Eds.

which, of very various dates and unequal value, was saved on my hurried departure for Europe.

Genus Axis. Read canines in males only or in both sexes. And below as follows: Their breeding time is spring, their rutting season, autumn. They gestate about 6 months. Horns cast in January, and, in confinement at least, not perfect till June-July. With September, when the horns are in full perfection the males begin to rut.

Character of Moschidæ,—add Gall-bladder constant; and in the native names, for Múskhi haran, read Múskh simply. Character of the Cavicorniæ minores, add Gall-bladder constant. Character of the Antilopidæ for canines constant, read canines rare. Genus Antelope, add canines none. So also Genus Gazella. Genus Tragops. The name, I hear, is pre-occupied. Wherefore I substitute Tragomma. Colonel Sykes (Zool. Journal) says of this type, "Eye-pits very small." But there are certainly none in my samples nor in those of Procapra, though there be slight depressions in the sculls of both. Such embryotic organs however cannot be admitted as characters of genera, how interesting soever they be as indications of those links by which genera are connected.

Genera 13, 14, 15, 16. Add to the generic character of each, Canines none. Native name of Nemorhœdus, for Saraw read Saráon, vulgo Sarrow. Genus Kemas, for Calcic tufts? read, No calcic gland or tuft.

Genus Hemitragus,—add Horns in both sexes.

Genus Capra,—add no eye-pits.

Note. I have just ascertained by careful experiment that goats gestate 5 *lunar* months. Genus Ovis, the assertion that the wild type or Ammonoides gestates 6 months rests necessarily on native information. I feel confident that the gestation is identical with that of domestic sheep. Carvicorniæ majores, character of the group, dele "laterally;" and for mufle large, read mufle variable. Character of Bovinæ, for large angle, read acute angle, and for mufle very large, read mufle large and constant. Genus Bos. Type Bos domesticus, add this note. Domestic types are bad, but I have none other to refer to, Bos being a form proper to temperate climes and authors having rather lumped together than discriminated the various wild types of Bos and its allies. I believe however that Bos Scoticus, the Chillingham breed, and the Wizend of Germany, are genuine

wild types of Bos, as above defined, and if so, they should be at once and exclusively substituted and cited. Bubalus is the tropical, Bos the temperate, and Bison the Arctic, type. We cannot therefore look for a true wild Bos in India where it is represented by the very distinct but allied forms Bibos et Gavæus. The range of these latter beyond India is unknown; but judging by Cuvier's expressions I should say that some of his fossil and extant animals belong to one or the other. Genus Bibos. Character. After Cranium massive, add, nor compressed nor depressed. Genus Bison. Add as a note. Blumenbach says the Aurochs has a suborbital sinus. This, if correct, must refer to the scull some slight depression on which may indicate an embryotic character of analogy with other genera. But, as already observed, no osteological indication of that sort can be admitted as a generic character, for there is no developed and apparent organ. The Bison has some singular analogies with the cervidæ and this may be one of them. The Yak, a genuine Bison, has no trace of real suborbital sinus. I have now two female Yaks which came to me in December enceinte. They calved in April and July; and I am assured that the domestic Yak drops its calf at all seasons save dead winter. One of my young ones is very vigorous and sprightly, and its mother also: the other, dead.

Genus Bubalus: for Types Bubalus buffelus et B. Arna, read, Type Bubalus Arna, and add to the note, after "true Buffaloes," of which the Arna is the unquestionable, best and sufficient type. The tame animal is therefore needlessly as falsely cited.

It having been asserted in the Journal, No. 177, that that noblest of all the Indian Cervines, C. Affinis, is, in fact, not an Indian species at all, but an American, of which my sample was purchased for the Court of Nèpal by its Vakeel at Calcutta, I beg to state, first, that this idle story, originating with the vanity of the Upádhyas, was, with all the other circumstances of the case, thoroughly sifted by me and the Durbar before I published the species, and, next, that having referred the point a fresh to the present Resident Major Thoresby upon the appearance of the cited No. of the Journal; that gentleman wrote me as follows: "The story trumped up in the Journal, is baseless. The Deer in question was shot in the Mórang, so far as appears in Ran Bahádur's time, as was stated to you after much investigation."

Routes from Darjeeling to Thibet, by A. CAMPBELL, *M. D. Superintendant of Darjeeling.*

In March last, I had the pleasure to forward to the Society an Itinerary from Darjeeling to Lassa, which appeared in the April No. of the Journal; I would not so soon again be a contributor of conjectural information regarding this portion of the Himalaya if any thing at all was known to the Society of its geography: or if circumstances did not preclude the obtaining of precise information by the travels and observations of competent geographers. So it has been however, and the Sikim division of the mountains, with the contiguous border of Thibet, is as yet almost unknown to the public. This will, I am sure, be accepted by the Society as a sufficient excuse for the presentation of these Routes.

They have been compiled with a good deal of trouble from native travellers. The rude diagram annexed, exhibits the line of 7 routes from Darjeeling towards Thibet. Five of these pass all the way through Sikim to the Thibet frontier, and cross the Snowy range to the east of Kunchinjinga.* The remaining two run through Sikim to the north and westward of Kunchinjinga, and uniting at Yamgatcha in the Nepal territory, cross the frontier of that state into Thibet by the Kanglachema Pass.

Boundaries of Sikim.—Sikim is continuous with Thibet on the north and east from the western shoulder of Kunchinjinga to the Peak marked Notolah. Its south-east boundary is formed by the Rungoh river, which rises from Notolah and falls into the Teesta, dividing it from Bootan; on the north-west the boundary with Nepal is formed by the Kanglanamoo spur of Kunchinjinga and the continuous ranges of Singalelah, Phugloot, Jonglah and Myong, to the head of the Mechi river; on the west by the Mechi river and on the east by the Teesta river. The southern boundary is on the plain and continuous with our Province of Purneah.

Mountains.—The grand feature in the geography of Sikim is Kunchinjinga; it towers over all the neighbouring peaks of the Himalaya, and is I believe, one of, if not, the highest mountain in the world. The highest peak is about 40 miles north by west of Darjeeling, and is a

* For "Chola route," see Journal As. Soc. for April 1848.

stupendous object from every part of Sikim. Besides the highest peak of Kunchinjinga, and forming portions of this glorious mountain, are the subordinate ones of Pundeem, Kubroo, Nursingh, &c. covered with perpetual snow. To the north-east of Darjeeling and at no greater distance are the snowy peaks of Chola, Gangri and Yakla. These latter mountains, with the giant Kunchinjinga, form the great barrier between India and Thibet in this direction, and lying under their mighty shadows is the sub-Himalaya, which forms the principality of Sikim.

Rivers.—All the rivers of Sikim noted in these Routes have exit in the plains by the Teesta, or the Koosi. The Teesta is the great drainer of Sikim, and receives all the waters of its upper regions. The lower hills being drained on the west of the Darjeeling Tract by the Balasun and Mechi, and on the east by the Mahanuddi. The feeders of the Koosi which occur in the route viâ Kanglachema No. 1, all rise in Nepal to the north and west of the Kanglanamoo spur of Kunchinjinga, and by a south and westerly course fall into the Tambur or most eastern branch of the Koosi, the principal feeders of the Teestah. West of Kunchinjinga are the little and great Rungeet, the Rummam, the Kullait, Ratong, Chooroong and Rungbee. From the east of Kunchinjinga the Rungbo, Lachoong, Lachen, and the Teesta proper so called, which rises in the eastern face of Kunchinjinga itself. The Rungbo is sometimes called the little Teesta, and divides Sikim from Bootan above its junction with the Teesta, whence to the plains the Teesta is the boundary between these two countries.

The Tashirukpa and Choomachoo of the Route No. 1, rise in Thibet and are feeders of the Arun which is, I believe, the greatest branch of the Koosi.

The Machoo noted in the Yakla and Chola routes runs through Bootan and reaches the plains I believe by the Gudada, which falls into the Burumpootra at Rangamutty.

I hope by and by to furnish the Society with a protraction of these routes by Major Crommelin.

No. I.

Route from Darjeeling to Digarchi (Shigatzi) by Jongri and the Kanglachema Pass of the Snowy Range.

1. *Seriong viâ Tuqvor.*—Cross the little Rungeet, ascend to Goke,

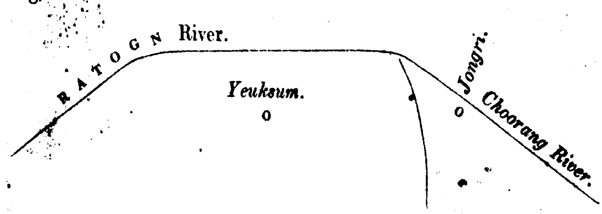
cross the Rumam and then ascend to Seriong, which is a village inhabited by Limboos and Lepchas. Direction north.

2. *Hee.*—Ascend to "Murmium Lah," then descend to encamping ground—a village of Limboos. Direction north.

3. *Pemiong Chi.*—Descend about a cos cross the Kullait river; ascend gradually to Linchong in an easterly direction, thence to Tigzhuk still in an easterly direction and by a gradual ascent. From Tigzhuk the direction is north and the ascent steep to Pemiongchi. The Kullait rises at Singalelah or Tolimbo. Old Sikim is about 2 miles from Pemiongchi to the east. The Lepchas name the Old Durbar "Pheeoong Ghurry;"—the Bhotiahs "Rabdengching;"—Limboos "Lapteuchi."

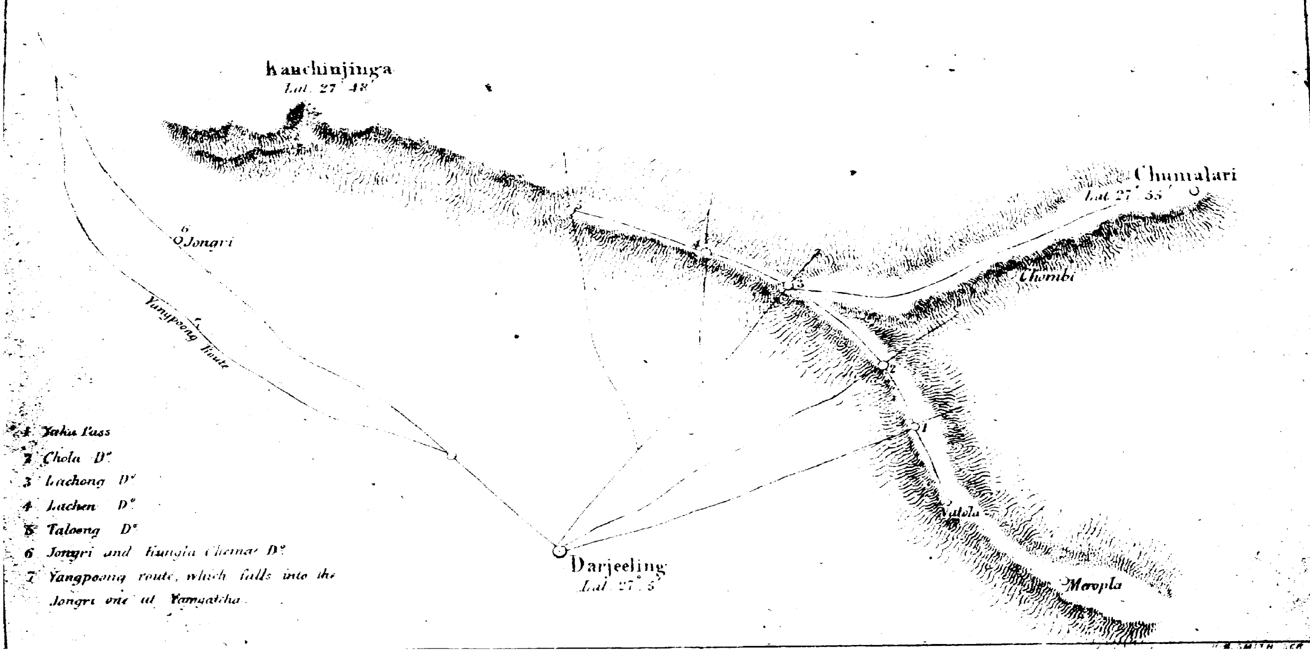
4. *Yoksum.*—Descend to "Chongpoom;" cross the Ringbi Nuddi, ascend to Tingleng, a village of Bhotiahs, Lepchas, and Limboos. Descend to and cross the Ratong river, whence ascend all the way to Yoksum where there is much level ground and which is a place of ancient note. Before there was a Raja of Sikim, there were three Goompas here, and it was the head Lamas of these who agreed that it would be desirable to have a king for their country, and they accordingly despatched Agents to Gantoke, whence the first Raja of Sikim was brought and installed. This individual had previously come from Thibet, was a Khamba, and the ancestor of the present Raja. "Yeuk," in the Lepcha language, means a chief; "Yeuksum" is three chiefs, hence the name of this place as the residence of the three great men above alluded to. Direction north by west.

5. *Jongri.*—Ascend gently in a westerly direction from Yeuksum. Descend a very little and cross the Ratong river, whence you ascend all the way to "Jongri." The Ratong rises from Kunchinjinga, takes a westerly course, where it is crossed in this march, and then turning round Yeuksum runs east to the Great Runjeet, which it joins at Tassiding, thus—



PL. XXVIII

DIAGRAM OF THE ROUTE FROM DARJEELING TO TIBET.



"Jongri" is at the west foot of Kunchinjinga and half a day's journey or less from the perpetual snow. The snow lies at Jongri for two or three months in severe winters and is continuous with the snow of Kunchinjinga, which descends a long way below Jongri and lies there in severe weather.

6. *Yalloong.*—Descend to the Choorong Nuddi, which is about 4 or 5 miles in a north-west direction, then ascend to the Kanglanamoo ridge, which is a spur of Kunchinjinga; thence descend to Yamgatcha, and go along the Yamgatcha choo due west to Yalloong, which is at the confluence of the Yalloong choo and the Yamgatcha choo. The Choorong rises from the east face of the Kanglanamoo, and falls into the Ratong, half a journey below Jongri. The ridge of Kanglanamoo is the boundary of Nepal and Sikim, and always has snow on it. The Yamgatcha choo rises from the north-west side of Kanglanamoo, and runs into the Yalloong river, which falls in the Tambur river two journies below Yalloong.

The Tambur is the great eastern feeder of the Koosi. Yalloong is a village in the Nepal territory, through which passes the trade from Thibet with Nepal and Sikim by the Walloongchoong and Kanglachema passes. Singalelah is about three journies from the crossing of Kanglanamoo above described, in a south and west direction. The ridge is continuous to Singalelah. Laden Yaks, sheep and goats, travel from Jongri to Yalloong and onwards by Kanglachema and Walloongchoong to Thibet. Direction N. W.

7. *Kanbacheu.*—Cross the Yalloong and ascend to the ridge of Choomjerma, whence descend to Kanglachen, which is a village of Bhotiahs on the river of the same name. Opposite the village—and across the river—is the Tassichooding Goomba, which belonged to Sikim when the Raja occupied the old Durbar, but since then it is in the hands of the Nepalese. The Kanbacheu river is a feeder of the Tambur, into which it falls one day's journey below Tassichooding Goomba. Direction N. by W.

8. *Nangola.*—An easy journey, the usual stage for unloaded travellers being "Yangma." Cross to the Tassichooding Goomba and ascend gradually to Nangola. Direction west by north.

9. *Yangma.*—Descend to the encamping-ground, which is on the Yangma river. On the opposite bank is "Mending Goomba."

The Yangma and the Walloong river unite half a journey below Mending Goomba and their united waters fall into the Tambur one day's journey from their confluence, whence the course is southerly. You may go on from Mending to Thibet by Walloongchoong, but the thoroughfare is to

10. *Kanglachema.*—Direction west by north. The route lies along the Yangma for half a journey, then leaving the river ascends to Kanglachema, which is the boundary of Nepal and Thibet, and is always under snow. The descent from Kanglachema to the Choomachoo is about 5000 feet; road good. No trees on north face of Kanglachema, nor any on this side above "Yangma"

11. *Choomachoo.*—Descend to this river, which runs west by south and into the Arun. It is the source of the Arun. At the crossing is the Tashirukpa Chaiten (Chaitya) a very fine and large one. Here 4 roads meet, viz. the Yangma road just described. 2. The Walloongchoong road. The Tokpay road, leading from Duncoota by the Arun river. Shingsha is at the junction of the Choomachoo with the Arun; there is a gola here. I have been to it from Tashirukpa all the way; the bed of the Choomachoo is the route for the greater part of the way; after leaving the bed of it I crossed the Kakula Pahar to Shingsha. It is too far round to go by the river all the way. From Tashirukpa to Kakula is nearly level; quite a plain, but very cold; Shingsha is in Nepal and here it is mountainous.

The Tashirukpa choo is a small stream which falls into the Choomachoo at the Chaitya.

12. *Koodoojong.*—Along the Tashirukpa all the way. The direction is north, country level and pretty well inhabited by Bhotiahs. No cultivation, it is too cold for anything to ripen. The people live by trading and get their supplies from Shingsha on the south: and also from the north. They keep Yaks, make butter from their milk and sell it. There is a Thibetan officer stationed here. He is styled "Neabo."

13. *Chankpook Goomba.*—The route lies all the way in the bed of the Tashirukpa river, which has still a southerly course. The country is level, and at the Goomba there are about 40 houses. There is cultivation here and wheat ripens; also pease, radishes and turnips. Koodoojong is like Phari; nothing ripens at either place. They are too near the snowy mountains. The country along this march is quite level.

14. *Sarrh.*—Direction north. The Neela range is crossed on this march. The ascent is commenced about half way from Chunkpook, and is not above 500 feet. No snow on Neela in August, or till the cold weather.

15. *Badong.*—Direction north, country level, but not cultivated; thinly inhabited by herdsmen who keep herds of Yaks and live by the sale of the butter, which is very fine. There are no trees nor shrubs even. The Yaks browse on short grass, and people use their dung as the only fuel.

16. *Dobtah.*—A hundred houses here or more. The people are all Bhotiahs, and cultivate a good deal. They are subject to the Sekim Raja and pay their rents at Choombi, which is 4 horse journey to the east viâ Phari, 6 on foot. The country is quite level from Badong to Dobtah, but very bare and stony. There is a large lake close to Dobtahjong and east of it. It takes more than a day to walk round it. It is very deep and has sweet water. The Tashirukpa rises from it. The name is "Tsomootethoong," which means the "Lake the mule drank of,"* and the origin of this is as follows. "There was a well here originally, but a mule one day knelt down and drank out of it. No sooner it did so than the waters rose and formed this large lake." The neighbouring lands are irrigated from it; the banks are grassy, and it is well stocked with good fish. There are no trees to be seen here and the cultivation is confined to wheat, pease, turnips and radishes.

17. *Kochoochen.*—About 5 cos over a level bare country, but thinly inhabited. There is a hot spring here which is used medicinally; it rises out of the level ground, not from a hill. The Sikim Raja visits it when he comes to Dobtah from Digarchi. When at Choombi he uses the hot springs of Kamboo Sachoo, which are near the Phari road at Bukcha. Kochoochen belongs to the Thibetans, not to the Sikim Raja. Direction north.

18. *Shejong* or *Bhejong* on the She river. This is the residence of a Soubah, and has about 100 houses. The route is due north and over a level country, i. e. there are but small hillocks scattered over a plain. No trees except the willow, which however is not indigenous but brought from a distance—Lachen-Lachoong. The only crops grown are wheat, pease, radishes and turnips; grass is abundant; rains

* Tso, lake; te, mule; thoong, to drink.

fall but seldom. There is more rain at Phari and Choombi than here. The "She" choo, which runs close to the village and the Soubah's residence, has here a westerly course, and I believe it falls into the Yaroo. The "Jong" or Shoubah's dwelling is on the top of a small hill, and this is the general usage in this part of Thibet.

19. *Looghri.*—Direction north; cross the Shechoo, which is fordable; at 2 cos further on ascend the Lassoom ridge, which is 2 or 300 feet high, and descend to your ground, which is on the plain.

20. *Digarchi.*—About 5 miles due north over the level land, which is very bare, nothing to relieve the eye except a few willows and the "Shaboo," a large tree brought from a distance and much liked in Thibet. Around Digarchi there is a good deal of cultivation, which is irrigated from the Painomchoo, which falls into the Yaroo about 2 cos below Digarchi. This is a good-sized river, not fordable in July, August and September; "it runs from the eastward, being close to Giangtchi, where it rises I do not know. It is as large as the great Rungeet; the ferries are served by leather boats. There is a bridge over it at 4 miles above its confluence with the Yaroo. The Yaroo comes easterly and takes a northerly turn at Shigatzi."

The Tingri road from Nepal is joined by this route a cos from Looghri.

No. 2.

Route from Darjeeling to Yamgatcha by Yangpoong Gola and Doomdonglah.

This route runs through Sikim to the west of the Jongri one, and by Tuqvor and Seriong to Hee, and thence to

Lingcheet.—Cross the Kullait river and ascend to Lingcheet; direction north by west.

Talett.—Ascend to the top of the Tengchok Yongchek ridge, cross it and ascend to this stage. Direction north-west.

Phiongdang.—Descend to the Rungbee-nuddi and go along its banks to this encamping-ground; direction north. The Rungbee falls into the Ratong below Yoksum.*

Choonjom.—Along the Rungbee all the way and due north. The Rungbee rises from the Singalelah ridge.

* See Jongri route.

Yangpoong.—Leave the Rungbee to the left and ascend to this place, where there is a customs chokey of Sikim. Salt is brought into Sikim by this route from Thibet, but the trade is liable to interruption from the Nepalese, who stop its passage in the portion of their territory through which the road runs beyond Choolongkook.

Gomothang.—Ascend the Pekionglah; cross the ridge and descend to this stage, which is on a small stream of the same name.

Chodomdong.—Cross the Gomothang stream and ascend along it to this place. There is a lake here which is the source of the Gomothang; it runs easterly and falls into the Ratong below the junction of the Choorong with that stream.

Choolangkeok in Nepal.—Ascend to the crest of Domdonglah, cross it and descend to this ground. The Domdonglah ridge forms the present boundary between Nepal and Sikim, and is a continuation of Kunglanamoo. There is a small stream at this stage; it is a feeder of the Tambur Koosi.

Yamgatcha.—Ascend and cross the Giroonglah, whence descend to this stage, where you fall into the Jongri road.

No. 3.

Route viâ Lachen and the Latong Pass.

From Choongtam, at the confluence of the Lachen and Lachoong rivers to

Dema.—All the way along the Lachenchoo, direction north-west.

Latong, on the plain of Thibet.—About 5 cos from Dema ascend to the ridge of Latong, cross it, and without any descent you are on the Table-land of Thibet. On either side of the pass there is a high peak. You can go round by the bed of the Lachen, but the pass is the better route. Taloong is on the Lachenchoo, which rises to the eastward from a lake near Cholamoo.* The Lachen cuts off Kunchin from the range to the eastward.

Geeroo.—Over the level land in a north by west direction, and here you join the road from the Dankia pass. There is a fifth route to Thibet east of Kunchinjinga and west of this Lachen one, of which I have no particulars. It strikes off at Garrh† on the Teesta, whence the

* See Lachoong route. † See route by Lachoong.

next stage is "Barfok," thence Lingjah "Ba;" at Taloong, the confluence of Taloong and "Ba" streams there is a Goomba. The Teesta proper is left to the west at Lingjah, where it is crossed to the east bank. The road beyond Taloong is not known to my informants, but it goes along the stream of this name and over the Tekonglah into Thibet; Takong is a continuation or spur of Kunchinjinga.

No. 4.

Route from Darjeeling to Choombi by the Yakla Passage of the Snowy Range.

1. *Darjeeling to Sumoong.*—Viâ Lebong-Ging and the guard-house above the Rungeet. Cross the Rungeet at the cane bridge, and ascend in an easterly direction to the encamping-ground, which is about 1000 feet above the river.

2. *Chadam.*—Direction easterly, with a good deal of ascent; Chadam is about the same elevation as Namgialatchi, from which it is one day's journey.

3. *Namten.*—Direction northerly and easterly. The road skirts the base of Tendong, and there is little ascent or descent. The Ting, a small feeder of the Teesta, is crossed on this march.

4. *Took on the Teesta River or Changchoo.*—Descend all the way from Namten to the Teesta. The Rungbo river falls into it 2 cos below this ferry.

5. *Nadok.*—Cross the Teesta on a bamboo raft (Sa pan) and ascend in a northerly direction to this place, which is inhabited by Lepchas and Bhotiahs.

6. *Dikeeling.*—Ascend almost all the way in a northerly direction. Dikeeling is a permanent village of Bhotiahs, with a good deal of cultivation in wheat, barley, maize, rice, kodu, buckwheat, &c.

7. *La Ghep.*—This is not the "La Ghep" on the Tumloong and Chola route, but it is the same name for the same thing; it means, *the other side of the mountain*, and it is here so called by the Thibetians, and means the other side of Yakla or the Pass. It would be quite correct in a resident of this side of Chola to call Tangzoo, La Ghep.* Ascend all the way from Dikeeling. There is snow here all the winter,

* See route from Tumloong to Phari, Journal As. Soc. for April, 1848.

and no permanent habitations onward to Choombi. Yak herdsmen however frequent La Ghep and Yakla in the summer and rains.

8. *Bangrong.*—Direction west by north with very little ascent; cross the Bangrong Choo, a small stream which falls into the Rungbo.* The forest continues to Bangrong and beyond it. The Doom Shing (yew) is abundant and so is the Kema, a large flowering tree which is peculiar to the snowy regions. It is common at Jongri.† "There are seven sorts of Kema distinguished by the colour of the flower." The Kema is neither Rhododendron or Magnolia; flowers in May and June, is strongly scented.

9. *Yaten.*—Direction east by north; a gradual ascent. The forest ceases before reaching this place, which is bare and rocky. Snow in winter, no inhabitants. The pass of Yakla is close by; travellers put up in caves at Yaten.‡

10. *Charafook.*—Ascend about 100 feet to the Yakla passage, which is over a narrow ridge; cross it and descend all the way in the bed of the Yakla Choo to Charafook. From Yaten to Charafook is not more than 4 cos. Above the Yakla passage on the left is the peak of Gangri, not more than 600 feet high. It is not covered with snow during the rains, is visible from Darjeeling, and is a peak of some note, and venerated by the Lepchas; it is second however in this respect to Kunchinjinga, but annual sacrifices are made to it, and a festival held in honor of it. To the right of the Yakla passage there is no peak or elevation of the ridge. The Yakla Choo falls into the Chola Choo (Tangzoo Nuddi, of printed Itinerary to Phari§) a cos from Gangajong, at which place their united streams fall into the Machoo. The course of the Machoo is east and into Bhootan. Gangajong is 3 or 4 cos to the east of Charafook.

11. *Choombi.*—Direction north; a short way from Charafook you leave the Yakla Choo, and at 2 cos you cross the Chola Choo;—about a cos further on and beyond E-tok you fall into the Chola road from Tumloong. There is forest at Charafook and onwards to Choombi, principally of pines and yews.

* The Rungbo divides Sikim from Bhootan to the east of the Teesta; its course to the Teesta is westerly.

† See route to Digarchi viâ Kanglachema.

‡ There are two lakes to the east of the road near Yaten.

§ Journal As. Soc. for April, 1848.

No. 5.

Route from Darjeeling to Digarchi by Lachoong and the Donkialah passage of the Snowy Range

The stages from Darjeeling to the Teesta are the same as those noted in the route to Tumloong, viz. by Namgialatchi and Temi to the Samphoo or Sanadong Ghat, whence keeping the west bank of the river the next stage is

Kedong.—The road is difficult and runs for the most part parallel to the river, and about 500 feet above it. General direction north by west.

Garrh.—West of the Teesta, ascend from Kedong to Singdam, which is a Lepcha village, thence descend to Garrh. Road difficult.

Balla Samdong, on the Teesta.—Direction due north; descent all the way to the Teesta.

Rungoon.—Cross the Teesta at the Balla Ghat* by a cane suspension bridge, and ascend to the encamping-ground; direction north, road good, and habitations along it.

Singtam.—Ascend a short way, cross the Singtam ridge, then descend to this stage, at which there is a village; there is a small stream which runs west to the Teesta.

Miangh.—Ascend the Miangh hill, cross it, and descend to the encamping-ground, direction north-west. The united streams of the Lachen and Lachoong fall into the Teesta below Miangh.

Namgah.—A good road, north by west, moderate ascent to Namgah.

Tongh.—About half way from Namgah you come to the Lachen Lachoong Choo, along the east bank of which lies this place. The Lachen choo rises from a lake beyond the snowy range, and after running west, penetrates the range at Latong, where there is a passage into Thibet, to be presently described. It unites with the Lachoong Choo at Choongtan, one day's journey above Tongh, and forms the Lachen-Lachoong feeder of the Teesta. The Teesta proper rises from the east of Kunchinjinga. The Lachoong rises from the Donkia mountain and runs down the passage that bears that name and to which this present route appertains.

* Sandong is Thibetian for ferry. Samphoo, the Lepcha word. Changchoo is the Bhotiah name of the Teesta; Lepcha, Runew; Limboo, Toongwama.

Choongtan.—At and just above the junction of the Lachen and Lachoong. There is a Goompa here, and a few houses of Lepchas; rice grows at the riverside.

Lachoong.—The road, which is pretty good, lies all the way along the riverside, west bank. The river is as large as the little Rungeet.

Yeumtang.—All the way on the west bank of the Lachoong, and close to it; direction north, road good, no inhabitants, and forest heavy.

Momay Samdong.—Still along the west bank of the Lachoong. There is a warm spring here; no forest, some Juniper bushes only.

Cholamoo.—Leave the Lachoong at Momay, and after proceeding some distance ascend the Donkia Lah for about 300 feet, when you cross the ridge through a pass or depression in it, flanked by two high peaks, which are not snowed before September. The pass itself is not snowed before November, and may generally be crossed till December, if the winter is not severe. The Lachoong is formed at Momay, by numerous small rills from the Donkia mountain.

From the pass to Cholamoo the descent is very steep and may be about 800 feet. Here begins the plain of Thibet. No inhabitants at Cholamoo.

Geeroo.—Direction west, road good and all the way over level land, which is quite bare of vegetation, and generally stony. The Lachen road over the Latong pass falls in at Geeroo.

Kambajong.—Direction west, road good and over level land, which has occasional hillocks rising from it. A village of Bhotiahs here, and some cultivation. The station of a Soobah.

The road from Choombi to Dobtah and this place is by Phari, which is three journeys to the east.*

Uchee.—Direction west and over level ground. Hot springs here of some celebrity, they deposit a white salt, called Peu, which is I believe carbonate of soda. No inhabitants here, country very bare and barren.

Koorma.—Direction north, cross the Tagilah, a ridge of 3 or 400 feet high, within a short distance of Uchee, then along a sandy plain to Koorma, which has 100 houses or so. The people are pastoral and traders, no cultivation.

* The stages are Dokshala, Mendingbooding, Phari; the road is easy and over the plateau of Thibet.

Potheet.—Direction north, road good and over level ground, no houses, a "Dennkang" or rest-house.

Rhejong.—Cross the Kiongola, a range of 300 feet or so. Direction north. Here you fall into the road from Dabtah to Digarchi. The Rhe Choo, which runs to the west, flows by the village.

Lassoom, and thence to Digarchi, as by the Kanglachema route.

Report on the Salt Range, and on its Coal and other Minerals. By ANDREW FLEMMING, *M. D. Edin., Assistant Surgeon, 7th Bengal N. I.*

On approaching the salt range from the Jhelum opposite Jelalpore, a traveller is at once struck with the brick-red tint and barren appearance which the strata forming the principal part of its steep southern escarpment present to view, and with the peculiar white color of the rock, which particularly to the westward, seems to cap the range, resting on the inferior red strata, with which it forms a striking contrast.

Height and course of salt range.—Its height as stated in Malte Brun and Balbi's Gazetteer is 2100 feet above the level of the sea, and from Jelalpore the hills stretch W. S. W. until within about 20 miles of the Indus, when they take a turn to the north, crossing that river at Maree and Kalibag in a N. W. direction, from which latter place they divide into two or three branches.

The part of the salt range which first came under our observation was in the neighbourhood of Pind Dadud Khan, where we arrived on the 19th March 1848. From thence, after examining a locality 10 miles to the eastward called Baghanawalla Davee, we crossed the hills to Choee and Kutass, marched down along the foot of their northern declivity to Noorpoor, crossed over the low hilly district towards Mokhudd, on the Indus, came down that river by water to Kalibag, which we reached on the 14th April, and from whence we returned along the south side of the range to Pind Dadud Khan, where our labors closed on the 28th of that month.

By adopting the above route, we were enabled to obtain a general idea of the structure of both sides of the range, and though, on account

of the lateness of the season, the extreme heat of the weather and the shortness of the time allotted for our researches, we were unable to examine in detail the whole extent of the hills, yet from the uniformity of character which, with one or two exceptions, these present at the different points visited, we feel assured that little of practical importance has been overlooked, and that the conclusions we have arrived at will generally be found correct.*

Foot of salt range.—Intervening between the Jhelum and the acclivity of the salt range in its eastern part, there exists a level plain which extends west towards the Indus and stretches down between the two rivers. In their immediate neighbourhood cultivation is pretty extensive, but towards the foot of the hills, the soil becomes extremely barren and is covered with a thick saline incrustation of sulphate and muriate of soda, which to most plants appears to be highly injurious.

Water.—The water in this plain becomes more and more brackish as one approaches the hills, that which issues from their base being a perfect brine and quite unfit for culinary purposes, the inhabitants being entirely dependent for the supply of this necessary, on rain water, or water brought from the Jhelum or upper point of the range, and which is collected in tanks. These are generally kutcha except in the neighbourhood of Pind Dadud Khan, where through the exertions of Misser Rulla Ram, the intelligent Superintendent of the salt mines, good sized pucka tanks have been constructed and yield an abundant supply of sweet water to the miners and natives around.

Rolled Boulders.—The commencement of the acclivity of the range is marked by a succession of small hills of a reddish sand, in which rolled boulders of rock become more and more numerous as one ascends, and at last cover the base of the hills. These are of all sizes, from a filbert up to a ton in weight, and consist of granite, gneiss, mica slate, porphyry quartz, limestone and red sienite closely resembling what is known in Scotland under the name of Peterhead granite.

* Since writing the present report we have had the pleasure of perusing a paper by Dr. Jameson of Saharunpore, which was reprinted from the Asiatic Society's Journal for 1843, in a late number of the 'Bombay Times,' and contains an account of his observations made during a trip to the salt range, which generally coincide with our own, although in some of the details we will be found to differ. We regret extremely not having been aware of the existence of this interesting article, until we found it in the pages of the Bombay paper.

Red sandstone conglomerate.—These boulders have resulted from the disintegration of the rocks superior to them, and particularly of a coarse red conglomerate on which the other strata of the range appear to rest, and which only here and there crops out under a coarse rusty red sandstone. The conglomerate is best seen on the Indus below Kalibag, where the imbedded boulders are numerous and of the same character as those to the eastward. In this, as also in the sandstone superior to it, no organic remains could be discovered.

Red sandstone.—Red saliferous marl with Gypsum and rock salt.—Succeeding to the sandstone, which varies in the thickness of its strata at different points, is a red ferruginous marl including beds of gypsum, both earthy and saccharine angular masses of which stand out in bold relief on the sides of the hills, the softer matrix having been washed away by the rains. The marl contains large crystals of Selenite or crystallized Gypsum, known to the natives under the name of *Aberach*, but they seem neither acquainted with its valuable properties when burned or of that of the Gypsum, which can be had in any quantity and with a very trifling amount of labor. The saccharine variety is generally of a light grey color with a shade of blue, translucent on the edges and yields a plaster of Paris by calcination, of good quality.

But of far greater importance are the deposits of rock salt that the red marl includes, and which we will merely allude to here as characterizing it, which though irregular in the depth of its deposit, seems to attain its greatest thickness in the neighbourhood of Pind Dadud Khan, thinning out towards Baghanawalla to the east, where no salt is excavated, but yeilding that mineral in abundance in all the western course of the range, with the exception of one or two localities, where the hills are of small altitude.

Variegated sandstones.—Above the marl, a breccia of masses of gypsum, sandstone and limestone cemented in a red calcareous matrix is occasionally to be noticed, lying unconformably on the marl, and to this succeeds a series of arenaceous and argillaceous beds, the prevailing color of which is blood red and presenting all the characters of the usual variegated strata of the saliferous formation. In the lower part of this series at Baghanawalla there occurs a succession of blue slaty soft argillaceous sandstones of considerable thickness, becoming highly calcareous towards their upper part, and above these is a light fawn

colored limestone on which rest the variegated sandstones and conglomerates interlaminated, with their beds of a bluish green indurated clay, nodules of the same being abundantly diffused throughout the strata. This limestone, though in appearance resembling magnesian ore, does not contain a trace of that earth, and is, as far as we could ascertain, devoid of organic remains.

Saline efflorescence.—Up to the highest point to which the variegated strata extend, their surface, as well as that of the rocks inferior to them, are incrusted with a saline efflorescence, which by solution in the water which flows down the valleys, renders it a perfect brine.

Absence of Organic Remains.---Ripple marks are by no means uncommon in the sandstones which, with the exception of what probably may be Fuci, are particularly free of fossils, a fact quite in conformity with what is usually observed in other countries in the red strata of the variegated sandstones. Whether these originally contained organic remains is a question which it is impossible to solve, but the same action, probably igneous in its origin, which has caused the peroxidation of so much iron in the strata, and to which they owe their color, may have destroyed any traces of organisms which at the period of their deposition they may have contained. That the rocks composing the salt range have been exposed to violent disturbing agencies is evident from the contorted and confused appearance which in many places they present, and from the general dip of the strata to the N. at angles varying from 40 to 50 degrees. What the elevating power may have been which has raised these to the position they are now in we will not presume to offer a conjecture, but the absence of Plutonic rocks in situ among those of the salt range, might lead us to seek for an explanation different from the usual one which these afford of the elevated position of strata. Much of the disturbed appearance which the red marl and sandstones present, is the result of ordinary causes, the most important of which are the periodic rains which in tropical climates produce such extraordinary effects, and in the salt range by undermining the rocks, cause immense slips, which give rise to a state of confusion among the strata often most embarrassing to the observer.

Calcareous strata with Fossils.—Above the variegated sandstones are others of a lighter tint alternating with light yellow sandstones, calcareous conglomerates and coarse limestones. These are well seen in

the neighbourhood of Pind Dadud Khan, at Noorpoor to the westward, and are much developed at Kalibag. To the east of Pind Dadud Khan they are very deficient, and do not exceed a few feet in thickness, being represented by a soft yellow fine grained friable calcareous sandstone and yellow marl.

In these strata organic remains, exclusively of marine origin, are found in considerable abundance, particularly at Kalibag, Musakhail and Noorpoor. Nummulites and other Foraminifera abound, becoming more and more plentiful at a higher position in the series of rocks forming the range.

At Kalibag Belemnites associated with Ammonites, species of Echinodermata corals, &c. occur, their color being light brown. The former have never been found in strata inferior to the Lias formation, and this circumstance, together with the fact stated by Professor Ansted in his excellent work on Geology, that Echinidæ for the first time in an ascending order appear in rocks of the Oolitic Æra, induce us to believe that the variegated strata of the salt range are succeeded by others of a different formation, which in all probability belong to an age more recent than the Lias. At Musakhail, about 10 miles E. of the Indus, the fossils found in the limestone differ considerably from those of other localities, and will be noticed hereafter.

Lower Yellow Marl.—We have alluded to a yellow marl as occurring above the calcareous strata. This is seen along the whole of the range, presents a strikingly uniform appearance and is full of marine shells, some of which do not occur in the strata inferior to it.

Bituminous Shales including Seams of Coal.—The marl forms the basis of a series of bituminous shales interlaminated with beds of blue clay and full of iron pyrites and large crystals of gypsum. These shales differ much in thickness at various points, and include seams of coal. A few shells are occasionally to be found in the shales similar to those of the marl on which they rest, and in a marl of the same character which is superimposed and passes into a very compact limestone of a light grey color, sometimes however separated from it by strata of a yellow calcareous sandstone of no great thickness.

Upper yellow Marl.—The upper marl is in some places so compact and composed of the comminuted remains of shells and a few corals, as almost to entitle it to the name of shell limestone. From it we obtained

two species of Echinidæ and a single tooth resembling that of a shark, which is the only trace of the remains of vertebrata, we had the fortune to discover.

Compact Nummulite Limestone with Flints.—The compact limestone, from its light grey, almost white color, and the great abundance of flint nodules deposited in it in regular layers, together with the appearance of its fossils, which are sometimes incrusted with a white chalk, has a certain resemblance to some of the older members of the cretaceous formation.

Chemical character of Limestone.—Its fine grained, almost flinty appearance, at first sight induced us to believe it was highly saliceous; but this is not the case, it being a very pure limestone, rapidly dissolving in diluted acids and leaving a mere trace of clay or mud. Its weathered surfaces have a glazed appearance, and present occasionally an oolitic structure, which is caused by the numerous nummulites and other foraminifera which frequently form the rock. The influence of these and of the more minute but not less wonderful class of infusorial animals in building up the crust of the earth is well illustrated in the strata of the salt range, all of which appear to be of marine origin, the sea at the time of the formation of the upper deposits having been highly charged with calcareous and saliceous matter, which through the agency of these minute organisms has been separated from their solutions and deposited in the masses we now behold. This limestone, which for the sake of distinction we will call *nummulite limestone*, forms the ridge of the hills presenting a steep southern escarpment from 150 to 200 feet high and giving to the range the peculiar white color before alluded to. It presents indistinct marks of stratification, except in its lower part, but reposes conformably, as far as we could ascertain, on the rocks inferior to it. Its surface, as exposed in the precipices on the southern escarpment of the range, weathers into large cubical masses, which give it the appearance of a wall built of loose fragments of rock, which by their gradual disintegration have fallen down and cover the declivity of the hills over a considerable surface, rendering their ascent a matter of no ordinary labour.

On surmounting the saliferous strata the saline efflorescence before noticed, as occurring on their surface and on the banks of the small streams which flow down the ravines, entirely disappears, and the water

which issues, but in small quantity on the south side of the range from the strata above, is sweet and pleasant to drink.

General appearance of vegetation.—The difference in the character of vegetation in the two districts is also striking in the extreme. Where the salt prevails, the few plants which occur are, with one or two exceptions, diminutive and unhealthy, but on reaching the limestone their appearance changes to a lively green, grasses and ferns are to be seen along the sides of the rivulets; and an Acanthaceous shrub which abounds generally throughout the range, becomes of at least twice the size. But the contrast is even more striking when the summit of the range is reached.

From this the limestone dips to the N., presenting on the northern declivity of the range a series of valleys separated by rounded hills. By its disintegration, it yields a soil which in the valleys is productive of excellent crops of wheat and barley, where the loose stones have been removed. These are generally piled up around the fields into low walls and remind one of the peculiar fences so common in the counties of Kincardine and Aberdeen in the north of Scotland, and known under the name of consumption dykes.

Calcareous Tufa, used as a source of fine Lime.—In some places, but particularly in the neighbourhood of Dundhote, Choee and Kutass, the surface of the limestone is covered with a deposit of calcareous Tufa, passing here and there into Travertine, and frequently containing impressions of leaves and fragments of wood. This Tufa is extensively burned by the natives and yields a lime of a perfectly white colour, admirably suited for a building cement. The nummulite limestone is also burned for chunam, but as the Tufa is soft and easily excavated, it is generally preferred. It has apparently been deposited from springs, the waters of which were charged with calcareous matter, held in solution by carbonic acid, but none of these appear now to exist.

Springs.—Springs are generally abundant in the limestone district on the N. side of the salt range, but no hot ones occur as far as we could discover. The natives assert that such do exist, but those pointed out to us as hot, were at the time we visited them, cooler than the atmosphere, being on account of the depth from which they spring, unaffected by the ordinary changes of atmospheric temperature. Such

springs usually indicate the mean annual temperature of the district, and hence appear to be hot in winter and cold in summer.

Tank of Kutass.—At Choee several streams of water issuing from the limestone hills unite to form a good-sized clear stream, along the grassy banks of which a road leads to Kutass, famous for its tank of water, a sacred resort of the Hindoos, and around which numerous faqueers have taken up their abode in fine mansions built by different Sirdars who have made them over to the holy men. This tank is supplied by the stream above mentioned, and has no apparent outlet from the limestone rock which surrounds it. Its depth is declared to be unfathomable by the faqueers and natives of the place, who informed us that Runjeet Sing, Burnes and several others had tried to ascertain it, but without success. A faqueer too, it is said, was engaged for two years manufacturing a rope, but in this period could not make one of sufficient length to fathom its abysses.

Being anxious to ascertain the truth of the statement, we got a charpoy tightly bound on four inverted gurrahs, and having seated a man on this frail craft, directed him to navigate it about the tank, taking soundings in our presence, at the different points, stated by the Faqueers and others as those of greatest depth. To their great disgust however, the deepest part was found not to exceed 23 feet, and as the soundings were repeated in so many different places within the area of the tank, we are inclined to believe that its depth is entirely fabulous, and that the story has been invented and perpetuated by the cunning faqueers, with the view of conferring greater sanctity on their pleasant residence. Probably the water escapes to a lower level through some crack or fissure in the limestone, and we suspect that a considerable stream of water which we observed to the westward at a place called Nurwa near Kuhar, is the drainage of the above tank. At the time we visited it, thousands of pilgrims were bathing in its clear waters, and a fair was being held in the town, giving the place quite an air of bustle and importance.

Soft Sandstone strata with Conglomerates, &c.—All along the north side of the salt range from Kutass to Noorpoor, the nummulite limestone occurs full of flints, rising up by a series of rounded hills with intervening valleys to the ridge of the range. To the north of Kutass and extending east and west along the foot of the hills, strata of a

much more recent date occur, resting on the limestone and gradually covering it from view. These consists of calcareous conglomerates, including small boulders of primitive rocks, sandstones and limestones, identical with those found in situ in the range, and gradually passing into highly calcareous friable grey sandstones interlaminated with beds of blue and red clay, occasionally inclosing patches of conglomerate, which towards the Indus at Mokhudd become very abundant. The dip of these strata diminishes regularly as one descends from the range into the plain, stretching north to the Hazara country and westward to the Indus, where they are nearly horizontal and are covered with a very thin soil on which but little vegetation exists. On the banks of nullahs and neighbourhood of wells which are but thinly scattered the water being at a great depth from the surface, fair crops of barley, wheat and grain are raised, but the culture of the two former is rather precarious from the great droughts to which the district is liable.

Gold.—Gold is obtained in considerable quantity in this district, being washed from the sands, which have resulted from the disintegration of the soft strata in the beds of the numerous nullahs which intersect the country and during the rains pour their waters into the Jhelum and Indus.

With the exception of some indistinct vegetable organisms associated with masses of jet near Kuhar to be afterwards noticed, and still more indistinct traces of amulidæ in a fine indurated clay, we did not observe any organic remains in these strata. The large amount of calcareous matter which the soft sandstones contain and which by solution in a weak acid, leaves the sand in its original state, has doubtless been derived from the calcareous waters which seem to have existed at the time of their formation. At no point does the lime appear to have been more extensively diffused through the strata, than at Mokhudd, where the Indus, about 300 yards wide, rushes with considerable force between two walls of conglomerate, presenting the appearance of a hardened mortar into which, in a soft state, rounded boulders of all kinds of rocks had been indiscriminately thrown.

From Mokhudd downwards to Kalibag in the course of the Indus, admirable sections are seen of these more recent strata on both sides of the river, which from a position of comparative horizontality, gradually ascend towards the central ridge of the range,* and at Dundhote, about

2 miles above Kalibag, dip to the N. at an angle of 35°, forming rugged precipices of considerable height, which overhang the river.

The sandstones become more and more compact as the central ridge of the range is approached, have a dirty red colour and are seen to rest on the nummulite limestone, beneath which the usual deposit of bituminous shales, strata of variegated sandstones and saliferous marls occur, and are well seen at Kalibag, where the Indus escapes from its rocky channel into the wide plains of Esaukhail and Kutcha.

Coal of the salt range.—From the remarks which we have made in the course of our report, it will appear that the oldest formation noticed in the salt range, and that on which the others are based, is a number of what is commonly known under the name of the new red sandstone formation—a formation, which as far as the observation of geologists have yet extended, invariably occupies a position superior to the true coal measures in the crust of the earth, and has never yet yielded a coal of any commercial value. The neglect of this fact has on too many occasions been the cause of the outlay of large sums of money by individuals who, had they possessed but a slight amount of geological knowledge might have saved themselves from much disappointment.

The remark of Sir H. De la Beche, on this subject, is so true, that we give it in his own words. He says, "a little black shale or piece of lignite is often sufficient to cause the expenditure of £2 or 3000 in localities where there is not the slightest probability of success."

"Good bituminous coal," says Ansted, "fit to be worked extensively for economical purposes, does not occur out of the carboniferous group of rocks in Great Britain," and the same rule applies to the continent of Europe. To declare however, that no good bituminous coal will ever be found on the surface of the globe except in the position above stated, would be rash in the extreme, and the researches of Professor Rogers in Eastern Virginia, in the United States of America, would seem to render it extremely probable, that the thick beds of coal, which there occur, do not belong to the true coal measures, but represent on a large scale, the coal fields of Brora in Sutherlandshire, which has been worked from time to time since the close of the 16th century, and which by the researches of Mr. Lyell and Sir Roderick Murchison, have been clearly proved to belong to the oolitic formation. Similar deposits of coal occur and have been worked at Scarborough, &c., but

these, as well as the lignites of the tertiary strata of the Rhine, &c. present characters so totally different from those of true bituminous coal, and usually contain such a large amount of earthy matter intimately mingled with their component structure, that they are incapable of giving out a continued heat, and have only been worked, in the absence of other fuel or in localities where they occur near the surface and are easy of extraction.

We have already mentioned the bituminous shale, or in other words, the carboniferous deposit of the salt range, and its geological position among the other strata. That it is more recent than the saliferous formation we entertain no doubt, and are inclined to refer it to the oolitic era, believing that the coal in general character will be found to bear a close resemblance to those coals above alluded to as occurring in that formation.

General character of the Coal.—In general appearance the more compact specimens of the coal of the salt range, procured from parts of the seam out of the reach of atmospheric influence, resemble that variety known under the name of splint coal. It is however much softer and more brittle, and its relationship to the more imperfect class of coals, known under the name of lignites, is established by the fact of the occurrence of patches of brown half-decomposed vegetable matter associated with it, and at times to be found included in its most compact portions.

To the natives of the district its properties, as a fuel, are unknown, but under the name of *Sangee Momiai*, it is used by them as a medicine, given internally in powder along with milk, in all bruises or wounds both of men and animals, the cure of which it is said greatly to facilitate.

The coal is somewhat difficult to ignite, and at first emits a large quantity of smoke. When combustion however is once established, it burns without caking, gives out a considerable amount of flame and heat, and leaves a large quantity of ash.

It is particularly free of iron pyrites, which abounds in the bituminous shales, with which it is invariably surrounded, and hence in burning gives out no sulphurious smell, an objection to which lignites in general are liable.

For the purposes of steam navigation, or when flame with a moderate

amount of heat is desireable, we believe this coal would answer well, but it is certainly not adapted, from the small amount of coke it yields, for the smelting of ores, where a high and continued heat is so urgently demanded.

The point of the salt range where the coal appears to be best developed, is in the neighbourhood of Pind Dadun Khan and to its eastward, while towards the Indus, and particularly at Kalibag, it does not occur in a seam of any size, but is spread through an immense deposit of bituminous shales, in thin films, rendering them admirably adapted for the purposes of alum manufacture.

All the localities which we had an opportunity of examining, where the coal crops out, are on the southern escarpment of the range. It is best seen at Baghanawalla, Keurah, Dundhote, Ruttipind and Noorpoor, where the coal is of pretty good quality and in considerable quantity. At Mukrass, and Numbhul, or Bukkh, the same coal occurs but it is of inferior quality and in but small quantity.

We shall notice these different localities as they are situated, proceeding from E. to W., and here we may state that it appears to be the same seam or seams, which run along the whole extent of the carboniferous deposit.

Baghanawalla Coal.—This coal was first brought to the notice of Sir H. Lawrence by Lieut. Robinson of the Engineers, who forwarded samples of it to Lahore in the autumn of 1847. From these we made an analysis, the results of which, along with a few remarks on the general character of the coal, were laid before the Asiatic Society in February, 1848.

Baghanawalla Davee is a small village about 10 miles E. of Pind Dadun Khan and about the same distance from Jelalpore. The coal seam occurs in a ravine about 3 miles N. E. of the village among the hills. The access to it is very difficult and steep, and no beast of burden can at present approach it. It is included in shales and yellow marl resting on the variegated sandstone strata, above which is a shell limestone passing into cherty limestone, which apparently is the representative of the calcareous deposit so abundant to the W. but which at this point is but little developed. This is not more than a few feet thick, and on it rests a grey friable sandstone, which is succeeded by a series of soft arenaceous strata forming a range of low hills running

N. N. E. towards mount Doomeyala, and between the village of Futtipoor and Mount Tilleh. In some places, and particularly where it crops out in the ravine, the coal appears of good quality in a seam 5 feet thick, and on each side of this can be traced for at least ½ a mile, in some places appearing to degenerate into highly bituminous shales. The seam dips conformably with the strata above and below to the N. N. W. at an angle of 45° or 50° which would render the sinking of a shaft through the strata, superior to the coal, in such a locality, a matter of considerable difficulty and expense.

Keurah Coal.—This occurs above the salt-mine village of Keurah near Pind Dadun Khan, and about a mile to its N. E. It is seen cropping out on the side of a ravine, the access to which is as difficult as to the locality last described. The coal is found in the same geological position, above the variegated sandstones, and is included in a series of thin laminated sandstone marls and bituminous shales, the latter of which are charged with aluminous earth and iron pyrites, and are here and there incrusted with an efflorescence of sulphate of iron and alumina. The seam is about 2 feet thick and rests on a blue clay inclosing septaria, into which we dug 6 feet without getting through it In this as well as in the shales large crystals of gypsum are abundant. The coal appears to dip with the other strata to the N. W. at an angle of from 40° to 50° and may be traced across the ravine for about 30 yards, where it seems to thin out among the blue clay on which it rests. Where exposed to the atmosphere it is very brittle and covered with a yellow crust of iron alum, but on digging into the seam it is of good quality, pretty hard and compact, but here, as in other places, affording abundant evidence of its imperfect mineralization. Above the coal shales the same yellow marl occurs, and is succeeded by a considerable deposit of the nummulite limestone, on which repose a series of soft sandstone strata, that have evidently been much disturbed.

Ruttipind Coal.—This locality is to the W. of the road to Kutass, and about 3 miles from Keurah. The coal occurs among shales from 30 to 40 feet thick, full of large crystals of gypsum and pyrites and interlaminated with their films of yellow clay. Two seams occur, the lower one two feet thick, and separated from the upper, by shales of about a foot in thickness. This measures 4 ft. and along with the other may be traced down a deep ravine for 50 or 60 yards. The coal does

not appear so good as that of Keurah, being very brittle and containing a quantity of earthy matter. The dip of the strata is here to the N. at an angle of 35° to 40°. Above the shales is seen the yellow marl and then a bold escarpment of nummulite limestone, on reaching the top of which the village of Ruttipind is seen in a valley on the northern declivity of the range.

Dundhote Coal.—This seam is only about 2 feet thick, occurs in a similar position and is of much the same quality as the last. The only access to the locality is by a footpath very difficult to ascend, and above the coal seam the nummulite limestone with flints rises to the top of the range on which the Fort of Dundhote is built.

Mukrass Coal.—Coal also was found at this locality by some of Misser Rulla Ram's men, who brought me specimens, on my return from the Indus. It is of inferior quality, but evidently part of the same seam as noticed above.

With the exception of Baghanawalla the localities mentioned are included in a circle of 4 or 5 miles, in the neighbourhood of Pind Dadun Khan, and though these were all we had an opportunity of examining, yet doubtless at numerous other points both E. and W. the same seam will be found to crop out if due search be made.

Noorpoor or Nilawan Coal.—We are satisfied on this point, as at Noorpoor, 15 miles west of Pind Dadun Khan, we found a coal of a character identical with what occurs to the eastward. It is to be seen above the Nilawan salt mines, in two small 8 inch seams, included in shales on which a steep escarpment of the nummulite limestone rests at least 150 feet high. The coal seam dips to the N. W. at an angle of from 25° to 30°.

Numbhul or Bukkh Coal.—Between Noorpoor and the Indus only one locality came to our notice, where coal occurs. This was in the neighbourhood of Musakhail, about 3 miles from Numbhul, at a place called Bukkh. The position of the coal appears identical with that to the E. being included in shales beneath the nummulite limestone forming the ridge of the range. It is best seen in a deep ravine formed by a stream which escapes from the hills into the plain near Musakhail, presents a charred appearance, and patches of it occur in a calcareous white sandstone which is in relation with the shales at their inferior part. This appearance is no doubt the result of the shales charged

with pyrites; having during the oxidation of the latter undergone spontaneous combustion, a phenomenon of frequent occurrence, and one which has produced much mischief in some of the British collieries. From the shales downwards to the base of the hills on the S. W. side, there is a development of calcareous strata evidently superior in geological position to the red saliferous marl, and which we have observed nowhere in the range to the same extent.

In contact with the shales is a calcareous sandstone which gradually passes into strata of limestone of a light bluish-grey color, containing abundance of nummulites, and towards the base of the hills enclosing layers of flints. These latter have a brownish tint, derived from peroxide of iron, with which they are frequently incrusted, but in none could we detect organic remains, which abound in the limestone, and particularly in its lower strata, which are of a much darker tint, and coarser character, than the upper beds. From the former we obtained several specimens of shells of the genera Productus, Terebratula, and probably one Spirifer, associated with Ammonites, Belemnites, &c. The appearance of these fossils, as well as of the limestone in which they are imbedded, is more ancient than that of any of the other fossiliferous strata we have noticed. Shales of the genera Productus and Spirifer are generally considered characteristic of strata inferior to the Lias, and abound in the magnisian limestone. There are however exceptions to this, and at least 3 species of Spirifera, and we think one or two Producti have been found in the Lias itself. Terebratulæ are by far the most abundant of all the fossils we noticed in the limestone, and this genus has been found to occur through all the strata from the chalk formation downwards.

At first sight we were inclined to believe that we were dealing with magnesian limestone, but on subjecting a portion of it to chemical analysis, we failed to detect any magnesia in its composition, which earth does not, as far as we can ascertain, exist in any limestone of the salt range.

We regretted much that our time did not permit us to examine this interesting deposit more thoroughly, as we are satisfied that from it a very fine collection of Fossil shells could be made, by which the true age of the calcareous strata might be established. In the ravine where the coal is seen beautiful sections of the strata are exposed to view, which

from the top to the hollow of the range seem to dip to the N. E. at an angle of 45°.

From the preceding details of the character of the coal seams, it will be apparent, that a very considerable quantity of fuel could be obtained from the various localities mentioned. At present however no beasts of burden could reach the places where the coal crops out, these being near the top of the range, and hence, until a road or path could be made, a work in these rugged hills of some difficulty, the mineral would have to be carried by coolies to a depôt, from whence it could be removed by bullocks, mules or camels, to the banks of the Indus or Jhelum.

By working the coal from the surface when it crops out, and parallel with the seam, it could be easily obtained, although considerable annoyance would be experienced from the falling in of the soft strata and loose boulders of rock which cover it. Until some locality is found where the coal seam appears of regular thickness and not developed in nests or patches, as we are inclined to believe is the case in the salt range generally, we could not recommend to government the propriety of attempting mining operations, except on a small scale, and by way of experiment. Perhaps Baghanawalla Davee and Keurah would be the most favorable positions for such attempts, which could be made at a moderate expense, labour being so cheap in the district and the inhabitants experienced in mining.

Jet Coal.—Besides the coal seams we have noticed, we met with a variety of coal at Kuhar, on the north side of the salt range, and at Kalibag, on the Indus, totally different both as to the geological position in which it is found, and in its physical characters, but in a commercial point of view, likely to be much less valuable than that we have previously described. It is what is known to geologists and mineralogists under the name of Jet, and never occurs in quantity sufficient to render its mining a work of any practical importance.

Kuhar Jet Coal.—This coal occurs among the soft calcareous sandstones which skirt the base of the hills. It is best seen at a place called Nurwa, a little to the N. of Kuhar, where a clear stream of fresh water has cut its way, to the depth of at least 200 feet, through soft sandstones interlaminated with beds of red and blue indurated clays, which dip to the N. N. W. at an angle of 25°. The coal occurs in flattened masses resembling the compressed trunks of trees, is of a glistening

black color, with a brown streak, and sectile when first removed from the rock. Its broken surfaces present a distinct woody structure, and brown patches of imperfectly carbonized wood, resembling peat, are frequently to be found in it. The Jet occurs but in small quantity, and would never be worth working.

Kalibag Jet Coal.—This coal, though in external appearance the same as the last, occurs in a totally different position, being found in strata inferior to the regular carboniferous deposit, and separated from it by a series of calcareous sandstones of a light yellow color, which are highly fossiliferous. Beneath these follow a succession of conglomerates of the older rocks and variegated sandstones and clays, towards the lower part of which occurs an extensive development of highly bituminous shales, in some places closely resembling coal, and interlaminated with strata of a white fine-grained sandstone, in which, as also in the shales, detached masses of jet occur, occupying a horizontal position, and may be picked out in considerable quantity. About 40 or 50 maunds of this coal and about the same quantity of bituminous shale supposed to be coal, were taken as fuel by Capt. Christopher in his return trip down the Indus in the "Conqueror" steamer. The results of his experiments with the jet coal, have, as was to be expected, been very favorable, and it is only to be regretted that the coal exists in small masses, evidently the remains of trunks of trees and no regular seam. In almost any portion of it which we excavated the woody structure was apparent, and in numerous specimens which we have preserved, nests of peat are to be observed in their interior, showing the imperfect mineralization of the coal, which presents even a less close approximation to the character of true coal than that which occurs in the regular carboniferous deposit.

The very short time we had at our disposal while at Kalibag, and the extreme heat of the weather, prevented us from examining the locality with the care we could have wished; for though our short search for coal was unsuccessful, the extensive development of bituminous shales in the strata around afford a hope that a seam of coal (though not of the true coal measures) may be found, which will yield a fuel suitable for the purposes of steam navigation.

In no part of the salt range have we seen a locality so fraught with interest, as at Kalibag, where strata are developed in many respects

different from those to the eastward, and from the careful examination of which much geological and probably practically useful knowledge may be obtained.*

Iron Ore.—The frequent occurrence of the most valuable of the British iron ores, known under the name of Black Band Ironstone, in the true coal measures, induced us particularly to search for this mineral and other iron ores, which might be found in relation with the carboniferous deposit of the salt ranges, but we regret to record that we met with but little success. Veins and nodules of hæmatite or red peroxide of iron, are abundantly diffused through all the strata of these hills, but the want of suitable fuel to reduce the ores to a metallic state, will, we fear, prove an obstacle to its being turned to much account. At Kamgoorum, 30 miles to the W. of Kalibag, iron is manufactured, probably from this ore, wood charcoal being used for its reduction. It is brought to Kalibag in the form of lumps of pig iron, which appear to be of inferior quality.

Petroleum.—This mineral is of frequent occurrence in the hills around Kalibag, and is obtained in considerable quantity at Jabba, S. of the Indus, and about 7 coss from Kalibag. It exudes from the rocks and floats on the surface of water. It is known to the natives under the name of *Gunduk ka tel,* who use it in place of oil in their lamps. We had not time to visit the locality where it is found, but from the enquiries made we are satisfied that it exudes from the neighbourhood of bituminous alum shales, and is probably one of the results of their destructive distillation, when undergoing the process of spontaneous combustion. The petroleum is of the consistence of tar, has a dark brown color, most penetrating smell, and burns with a yellow smoky flame. Its medicinal properties do not seem to be known to the natives, who use it only as a source of light.

Sulphur.—Associated with the petroleum, sulphur is also found in small quantity, and its origin is probably identical with the former.

Lead Ore.—The only other mineral which we shall notice is the galena ore or sulphuret of lead. This occurs in grains or small cubical

* We regret extremely our not being able to append a series of analysis of the coals from the different localities mentioned in the preceding pages, in consequence of the loss of the greater part of a small stock of chemical apparatus which we possessed, and which for a time we will be unable to replace.

crystals in a limestone near the Keurah salt mine, and in a similar rock on the N. side of the range, on a hill called Kuringuli, 2 miles N. W. of Chooe. The natives give it the name of *Soorma,* believing it to be sulphuret of antimony, of very fine quality, and is consequently in much repute among them as a cosmetic. It however contains no antimony, its only impurity being a trace of silver, which is generally present in galena, and sometimes in such quantity as to render its extraction a work of commercial importance. In the localities above mentioned the mineral occurs in such small quantity as to be of no value.

On the Salt Mines.—The mines from which the principal supply of salt is obtained, are those of Keurah, in the vicinity of Pind Dadun Khan, of Surdi, near Kuhar, and of Maree and Kalibag, on the Indus.

The general superintendence of these is entrusted to an agent of the Lahore state, Misser Gyan Chund, who, with his son Misser Rula Ram, reside at Pind Dadun Khan, where the largest salt depôt in the district exists.

Salt mine village of Keurah.—The mineral is brought in greatest quantity to the depôt, from a village called Keurah, about 4 miles distant, and around which no fewer than 10 shafts are sunk into the red marl for the purpose of extracting the salt. From the foot of the hills a narrow path, strewed with boulders and masses of rock, which have fallen from the height above, leads through a deep ravine to the salt mine village, which is built in terraces on its east side, and is inhabited by the miners and their families during the dry season. In the rains, on account of the heat and musquitoes, they desert Keurah and take refuge in the small village of Tobu, which is built on the opposite side of the ravine, but at a considerable height above the salt mines, and where they enjoy a cool breeze and an immunity from the attacks of their winged tormentors.

The inhabitants of these villages amount to about 650, four hundred of whom are employed in the salt mines, an occupation which, if we may judge from their appearance, does not seem to be particularly prejudicial to health.

Of the mines around Keurah two particularly deserve notice, and receive the names of the Keurah and Sujoowalla mines.

Keurah Salt Mine.—This is a little to the E. of the village, and on a higher level, the path leading to it passing over red marl containing

angular masses of gypsum. The entrance to the mine is by an opening cut in the marl about 7 feet high, and leading into a passage which preserves throughout a height of 6 feet and a width sufficient to allow two individuals to pass.

From the entrance to the end of the workings, the distance is 640 feet, where a chamber has been excavated entirely out of the rock salt 40 feet long by 30 feet broad, and about the same height, in which at the time we visited it men, women and children, were busily engaged quarrying the mineral by the light of small oil lamps, formed of the salt and hung by iron hooks on its walls the crystalline surface of which, reflected the light on a deep pool of brine situated in one corner of the chamber, and which is said to communicate with several of the neighbouring shafts.

In the interior of the mine, which was remarkably dry, the heat was most oppressive, and the thermometer hung on the rock salt stood at 85°, while in the shade at the mouth of the shaft it indicated 75°.

The appearance of the miners as seen in the dim light which illumined the mine, was highly striking, their faces and bodies being covered with a saline incrustation. Their dress is of the lightest description, the men wearing nothing but a bit of cloth wound round their loins, and a pad of numdah or thick woollen cloth tied over their skins to protect them from injuries from the sharp angles of the salt or blows from their instruments. These are but few, the one of most importance being a hammer sharpened at one end into a highly tempered point, combining advantages of a pick and chisel. With this and a small crowbar, almost all the salt is excavated, large hammers being occasionally requisite to fracture the larger masses of the rock.

The salt is generally removed from the mine in square lumps of such a size, that two will form a good load for a camel, by which animals it is conveyed, after being weighed at the mouth of the shaft, to Pind Dadun Khan, where it is sold at the rate of Rs. 2 per maund. the miners receiving from two rupees to two rupees eight annas per 100 maunds, according to the quality of the salt turned out.

Varieties of the rock salt.—The mineral occurs in three varieties, the pink, the white and the transparent, but the former is preferred by the natives for culinary purposes, from its containing, it is said, less *Reshuh*, a term the exact meaning of which we could not discover. The pink

color is generally supposed to be derived from organic matter, and is not the result of the admixture of a minute portion of iron or manganeese which the color might have led one to suppose.

Chemical characters.—When submitted to a chemical examination, all the three varieties of the salt are equally pure, and contain neither sulphate of lime nor chloride of magnesium, the common impurities of the mineral. In consequence of the absence of the latter, it is very slightly deliquescent, an advantage which it possesses over common bay salt, which if exposed to a moist atmosphere, rapidly attracts water.

What the thickness of the deposits of salt may be it is impossible to ascertain, but certainly that of the principal bed, in which the chamber is excavated, cannot be less than 150 or 200 feet. It does not seem to occur in regular strata, but rather in masses of irregular thickness, in which a stratified structure is observable, the general dip being to the N. at an angle of from 30° to 40°. These masses are separated from each other by portions of marl, including beds of gypsum, and are seen all along the sides of the passage, where they are occasionally worked. By the passing and repassing of the miners, portions of gypsum and salt have become highly polished in some places, and in the floor of the passage, where very imperfect steps exist, are extremely slippery.

Great annoyance is experienced particularly during the rains when al mining operations are suspended, from the falling in of the roof an sides of the various workings, which might in a great degree be pre vented and many lives saved, if proper means were adopted to suppor the marl and soft rock, as the salt is removed from beneath. A present this is done in a most careless manner, and hence the frequenc of accidents to the unfortunate miners, whose life is one of ill-remu nerated labour.

According to the Superintendent of the salt mines, from 48 to 50,00 maunds are annually obtained from the mines around Keurah, the or just noticed yielding alone about 15,000 maunds.

Sugoowalla mine.—This mine yields a very large quantity of salt of the best quality, and is very easily worked. The entrance to it, is abo ½ a mile to the E. of the Keurah one, and on a much higher lev From the surface, one descends the passage by a series of imperfe steps cut out of the marl, in which beds of salt occur close to the mou of the shaft.

In the interior of the mine, enormous masses of the mineral are to be seen, which have become detached from the roof and sides, and under which the various passages lead to an immense distance in the interior of the hills.

The temperature of this mine was much lower than that of Keurah, but having accidentally broken our thermometer we were unable to make any accurate observations. The amount of moisture which exists, and which is seen trickling in a small stream down the steps in the passage, may possibly be the cause of the comparative coolness of the mine, the roof of which was in several places covered with stalactites of salt upwards of a foot in length.

We were warned against entering this mine, which is considered unsafe, its roof and sides being rent and cracked in all directions. However any risk run was well repaid by the magnificent spectacle which the resplendent walls of salt afforded, dimly illumined by the twinkling lights of the miners.

Surdi Salt mines.—The salt mines of Surdi, about 10 miles to the W. of Pind Dadun Khan, have been more recently opened than those around Keurah, and appear to be constructed on a better plan, good flights of steps being cut out of the salt, which occurs in quantity close to the surface, and the roof of the passages well supported by strong beams of wood. The salt is of excellent quality, and remarkably compact. As it is raised from the mine it is conveyed on camels to a depôt about 2 miles from Kuhar, on the road to Kutass, none of it being sent to Pind Dadun Khan, but yielding a supply to Cashmír, and the districts to the N. of the salt range.

Kalibag Salt.—The salt is worked on both sides of the Indus above Kalibag, which village is built on the side of a hill of red marl, which extends along the N. bank of the river about a mile, and in which a vast deposit of rock salt exists.

The mineral is very near the surface, frequently cropping out and behind the terraced houses of Kalibag, forming a wall which overhangs the village. It is chiefly worked in the bed of a nullah called the *Loon*, a name derived no doubt from the character of its water, and which enters the Indus on its north bank opposite the village of Maree, where a large quantity of salt is also obtained.

No shafts are sunk in the marl as at other places, the rock salt hav-

ing fallen down in immense masses from the heights above the nullah, requiring only to be broken into portions fit for removal. On the east side of the marl hill the salt is of excellent quality, the transparent variety occurring in great abundance, but on the west side towards Kalibag, it is mixed with a great deal of marl and hence is little worked. The stratification of the salt is more apparent here than in any of the mines to the eastward, and the strata appear to dip to the N. W. at an angle of 40°.

The marl abounds in gypsum, which generally is of an earthy character, the saccharine variety being less abundant than in the other localities we have noticed.

APPENDIX.

On the Alum Manufactories of Kalibag.

Alum Shales.—Next in importance to the rock salt which the strata of the salt range afford, are the *Bituminous shales*, which abound in all its extent, in connection with the coal seams, and from which, at Kalibag, Alum is extensively prepared.

These, as before mentioned, contain clay, abundance of iron pyrites, and their seams of coal, by the mutual reaction of which on each other, especially during combustion, an alum is formed.

The shale or rol, as it is technically called by the natives, is brought from several localities in the neighbourhood of Kalibag, the principal workings of it being at a place named Chatah, where the shales, corresponding to those in which the coal occurs to the E. of the Indus, are about 200 feet thick.

Regular shafts are sunk for the purpose of excavating the shale, and one of those we measured, extended 207 feet from the entrance. From the soft character of the strata accidents to the miners are of very frequent occurrence, the risk of which, as in the salt mines, might be considerably diminished were proper means taken for the support of the roof and sides of the shafts. In one of these, the shales spontaneously took fire, five or six years ago, and from its mouth a column of smoke resembling that from the funnel of a steamer is constantly issuing, no means being taken to extinguish the chemical action going on in the interior.

The rol or shale, as it is brought to the mouth of the pit, is placed in bags made of kummul or country blanket, two of which are loaded on bullocks, a narrow path having been made to enable them to ascend and descend the rocky side of the hill to the bed of the Loon nullah, from whence a road leads by the side of the Indus to Kalibag.

Price of the Alum Shale at Kalibag.—In this way the shale is landed at the alum kilns at prices varying from 14 to 17 maunds for the rupee, the workmen being supplied with mining instruments, but obliged to provide bullocks at their own expense.

Alum Kilns.—The kilns form the most striking feature of Kalibag, their red mounds rising up here and there in the middle of the village, and the smoke which issues from them tainting the air to a considerable distance around.

Injurious effect of Alum Kilns on the health of the inhabitants of Kalibag.—The injurious effect of impure air on the workmen employed about these kilns, is abundantly manifested in their sickly, emaciated appearance, many of whom labor under chronic affections of the lungs. Goitre prevails to a considerable extent among the inhabitants of Kalibag, but whether this is attributable to the pollution of the atmosphere by carbonic and sulphureous gasses, to the highly calcareous waters of the Indus, or to other more obscure causes, we will not venture to offer an opinion. In other parts of the salt range, we did not notice particularly the prevalence of goitre, whereas at Kalibag it is very common, some of the tumours being of large size.

Number of Kilns in Kalibag.—In the village there are no fewer than 14 kilns, to each of which the necessary arrangements for the preparation of alum are attached, but at the time we visited Kalibag only 12 were efficient.

Formation of the Kiln.—In preparing the kiln, a thin layer of brushwood (generally Tamarisk jungle, which abounds on the banks of all the Punjaub rivers) is spread on the ground to an extent varying according to the size of the one about to be constructed. On this a layer of the rol or shale in fragments is deposited to the depth of about a foot, to which succeeds a second layer of brushwood and then another of shale. When several of these have been arranged, the kiln is set fire to from below, care being taken that the combustion is not too rapid, which from time to time is moderated by sprinkling water

on the shales. The kiln being well lighted, fresh layers of shale and brushwood are added, and when the whole has attained the height of 30 or 40 feet, it is left to burn, 6 or 8 months being generally sufficient to effect the thorough decomposition of the mass, which when completed has a brick-red color from peroxidated iron, its surface being covered with an efflorescence of alum, containing a large proportion of sulphate of iron or green vitriol.

Preparation of the Alum.—Close to the kiln, and on a level a little below its base, there is a baked earthen vat 12 ft. square by 1 ft. 5 in. deep. Into this a portion of the burned shale is thrown and lixiviated with water for several hours, which rapidly acquires a dark brown color. When a saturated solution of the soluble matter in the shale is obtained, it is drawn off from the vat by an aperture in its side (which during the lixiviation is stopped by a plug), into another vat of similar size, but on a lower level. Here the crude alum liquor is allowed to deposit any mud which it may contain, and is then run off into a third but smaller vat on a still lower level, where it is again allowed to deposit any remaining impurities. From this it is transferred into an iron evaporating pan, where it is rapidly boiled and mixed with a brownish impure salt called *Jumsan*, from which it derives alkali necessary to convert the crude alum into an alum of commerce. When a proper quantity of this has been added, which is judged of from the appearance of the liquid, the whole is allowed to settle, and the clear brown alum solution removed into vats, 8 ft. 8 in. long, 5 ft. 5 in. broad and 1 ft. 5 in. deep, a series of which are arranged beneath a shed, close to the evaporating pan. In these the solution, which is concentrated to a point a little short of that of crystallization, is allowed slowly to crystallize for several days. During that time small alum crystals are formed of a slightly pink color, derived no doubt from the impure mother liquor which contains a quantity of muriate and sulphate of iron. When a considerable crop of alum has separated, the crystals are removed from the vat, slightly washed with cold water on a sirkee frame and allowed to dry. These are afterwards fused in an iron pan, in their own water of crystallization, and when in a fluid state, are removed into large conical earthen jars or gurrahs, 1 ft. 8 in. deep, the same breadth at the shoulder, and 6 inches wide at the mouth, where for eight or ten days they are allowed to crystallize. At the end of this period a hole is made in the mass

of alum, which is generally hollow in its interior, the gurrah inverted and the uncrystallized alum liquor, should any remain, allowed to escape. The gurrah is then broken and the alum moulded to the form of the vessel, and removed to the depôt for sale and exportation.

By acting on successive portions of the kiln in the manner above described, the whole is by degrees exhausted of the alum which it contains.

Quantity manufactured.—The average daily expenditure in all the Alum works at Kalibag was stated to us to be only Rs. 12, while the amount of alum annually prepared is about 12,000 maunds, which at Rs. 3 per maund, the price of the article at the manufactory, will yield a return of Rs. 36,000 per annum.

It is indeed singular that a process almost identical to that employed in European alum works, should have been discovered and adopted by the natives of India, and practised by them for several hundred years. We could not ascertain how long alum has been manufactured at Kalibag, but the proprietor or Malik of the place, by name Ullah Yar Khan, a remarkably obliging and intelligent old man, informed us that his ancestors for eight generations had carried on the trade.

Alkaline base of Alum.—We have stated that the substance from which the alkali of the Kalibag alum is derived, is a brown salt called Jumsan. This seems identical with the saline efflorescence so abundant throughout the N. W. provinces, and particularly so in all the grass jungles and waste ground in the neighbourhood of Lahore, and which is chiefly composed of sulphate of soda, with a little common salt and a trace of carbonate of soda giving it an alkaline reaction.

For the supply of the alum manufactories the efflorescence is scraped from the soil in the jungle E. of the Indus, and is particularly abundant in the plain which skirts the S. side of the salt range at the villages of Gurree and Tuttee, 8 or 9 miles from the Indus. The efflorescence is denominated *Kullur,* and from it Jumsan is obtained by treating the former with water and drying up the solution of its saline matter in gurrahs exposed to the sun.

This on analysis turns out to be nothing but a mixture of sulphate of soda and common salt, with varying proportions of carbonate of soda, its quality depending chiefly on the amount of sulphate of soda which it yields.

In all the commercial European alums, as far as we can ascertain, the alkaline base is Potash or Ammonia—the former alkali being characteristic of British alums, while the latter occurs in those of France. In the alum of Kalibag however, and in another sample of alum of a different external appearance, which we obtained in the Jullundur bazaar, soda forms the alkaline base, a fact which the addition of Jumsan to the crude alum liquor first led us to suspect, and which a chemical analysis of the alum has subsequently confirmed. A soda alum, as far as we can ascertain from the chemical or pharmaceutical works we have at present access to, is only known as an interesting chemical preparation; but we are not aware that such has been noticed as a staple article of commerce in the N. W. provinces, and probably throughout British India.

Purity of the Alum.—Considering the coarse apparatus in which the alum is prepared, its purity is astonishing. It effloresces considerably on exposure to the air, has a slight pink color, arising from the presence of a little iron which strikes a blue color with yellow prussiate of potash, and only contains a trace of muriate and sulphate of soda.

Besides the alum we have just noticed, another kind is prepared, from a light grey shale, containing silky crystals of what appears to be subsulphate of alumina. It is found associated with the other alum shales around, but in small quantity. To prepare the alum, the shale in coarse powder is mixed up with the impure liquid, from which the alum crystals have separated. The mixture is then dried in the sun, in irregular shaped masses of about a seer in weight, and which are of a brownish color. When dry they get a second dip in the same alum liquor, and are again dried, becoming of a tawny yellow color, in which state, under the designation of *Kaee*, they are sold to dyers at 8 annas per maund. This alum is a mixture of sulphate of alumina and sulphate of iron, and where mixed with the infusion of pomegranate rind yields a good black dye.

Although alum is only manufactured at Kalibag, yet as the same shales occur in quantity to the eastward, similar manufactories might be established with advantage in other parts of the salt range—the only obstacle being the difficulty of access to the shale deposits, which, as well as the coal, might be brought to the foot of the range on bullocks, were paths made similar to the one which leads to the Kalibag alum shale pits before noticed.

Explanation of the Elevations of places between Almorah and Gangri, given in Lieut. STRACHEY'S *Map and Journal.*

The elevations of places on my route to the lakes of Gangri, additional to the few that were already determined by the Trigonometric and Barometric operations of Captain Webb, have been deduced, in the way common with ill-equipped private travellers, from the observed temperature of boiling water.

My thermometer was small and bad, unfurnished with proper boiling apparatus (which is essential to correct observations), and lastly, it was broken before any comparisons could be obtained with a standard instrument to ascertain its error, for which purpose I had sent it to the Simla Observatory. The deduced heights are therefore liable to a wide range of uncertainty, for which I have been obliged to make arbitrary allowances, assisted only by a few boiling observations at or near places of known elevation on my route, which are inserted in the accompanying table. As my instrument was not readable to less than half degrees,—that is, when boiling in a common kettle over a smoky wood-fire,—the elevations cannot pretend to any precision within 250 feet, and I have, in most cases, therefore, made them up to the nearest quarter thousand; but the other causes of error, affecting measurements of this sort, will at least double that range of uncertainty, and the results cannot be considered anything better than rough approximations within 500 feet or so.

I have made the calculations by Prinsep's Tables (given in the Asiatic Society's Journal), which, though not strictly correct or complete, suffice for such rough observations. The mean temperature of the stratum of air under measurement (which materially affects the resulting elevation), is calculated as is done by Herbert in his Survey of the Alpine Sutluj (vide Asiatic Researches), by assuming the rate of refrigeration of the atmosphere to be 1° Fahrenheit for every 300 feet of elevation, and by deducing, according to this supposition, the temperature of the air at the level of the sea from the *observed temperature and the approximate* height.

I have reduced one or two Barometric observations by Manson, recorded in the Asiatic Society's Journal, for a few places about Rálam and upper Jwár, the mean temperature of the column of air being calculated as just explained, and neglecting the minor corrections, for temperature of instrument and decrease of gravity, as likely to be compensated, more or less, by the capillarity of the tube, regarding which no information is forthcoming.

Table of Elevations of places between Almorah and Gangri, to accompany Lieut. H. Strachey's Journal and Map.

No.	Name of place.	Nature of observation for determining the Altitude.									Elevation above the Sea in feet.
			Barometrical.		From Temperature of boiling water by H. Strachey.						
		Trigonometrical by Webb.	Deduced Height.	Authority.	Date.	Hour.	Temp. of Boiling Water.	Temp of Air.	Elevation deduced.	Presumed Error.	
					1846.		°	°			
1	J. Strachey's hut on Binsar, near Almorah (estimated to be nearly 600 feet below top of hill, 7969 feet, T.) ..	..	..	..	21 Nov.	3 P. M	199½	57	7007	393	7400
2	Khazánchi's house, near St. Mark's Tower, Almorah, 50 feet below Tower (5488 B.)	..	..	..	7 ,,	10 A. M.	202½	59	5280	158	5438
3	Dol Bungalow, ...	..			4 ,,	sunset	201	52	6065	35	6100
4	Dew Dhura (vulgo Dee) Bungalow, ...	..	6867	W.	3 ,,	,,	199½	53	6948	81	6867
5	Pharka Bungalow, ...	..	5914	W.	1 ..	,,	201½	61	5880	34	5914
6	Lohughát (Mr. Ramsay's house), ...	..	5649	W.	31 Oct.	,,	202	63	5630	19	5649
7	Dhargara Bungalow, ...	..	..	..	29 ..	,,	204	65	4474	36	4500
8	Iron Bridge on the Sarju, 2 miles below confluence of Rámganga, estimated to be about the same height as Rámeswar, (1587 B.)	..	..	..	..	..	..	..	..	..	1600
9	Kantagánw Bungalow, ...	..	..	..	28 ,,	,,	205	64	3892	8	3900
10	Petoragarh (Major Drummond's house), estimated 25 ft. above fort (5549 B.)	..	..	..	27 ,,	5 P. M	202½	64	5328	256	5574
11	Satgarh (Major Drummond's hut), 100 feet below top of Pass, ...	..	..	..	25 ,,	sunset	201½	59	5859	41	5900
12	Singhali khán, (50 feet below Pass,)	..	..	..	24 ,,	,,	202	60	5579	21	5600
13	Village of Askot, (camp, 50 feet above,).. ..	5089	..	..	23 ,,	4½ P. M.	204	76	4519	570	5089
14	Garjia Ghát, (estimated 35 feet below confluence of Gori and Káli, 2059 B.)	..	..	..	21 ,,	5 ,,	208½	63	1918	176	2094

	..	..	..	21 Oct.	5 P. M.	208	67	2192	58	2250
15 Bank of Káli river under Balwakot, ..	..	..	..	20 ,,	5 ,,	207	69	2784	66	2850
16 Dhárchula, 100 feet above, ..	3794	..	..	..	..	..	..	..	..	3794
17 Confluence of the Relagárh with Káli River, ..	..	..	..	18 ,,	4½ ,,	204	72	4536	214	4750
18 Village of Kela, ..	3883	..	..	..	..	..	..	..	..	3883
19 Bridge on the Dhauli, under Kela, ..				..	..	..	..	..	..	3500
20 Confluence of Dhauli and Káli, (estimated 383 feet below No. 19,) ..	..	..	..	16 Sept. / 18 Oct.	5½ P. M. / 4½ P. M.	198 / 198	58 / 62	mean 7952	68	8000
(In Chaudáns.) ..	..	..		..	..	..	..	..	..	7750
21 Village of Titila, ..	..	..	..	..	..	..	..	..	..	10,000
22 Sosa village, (estimated 250 feet below No. 21,) ..										
23 Rholing Dhura, top of Pass, (estimated 2000 feet above No. 21,) ..	..	..	..	..	..	..	..	..	..	7500
24 Bunbun Hamlet, (estimated to be about the same height as No. 26,) ..	..	..	..	..	..	..	..	..	..	7250
25 Syankwang, crossing of the Gárh, (estimated 250 feet above No. 26,) ..	..	..	..	17 Oct.	4½ P. M.	199	62	7363	137	7500
26 Gala hamlet, ..						..	..	..	..	10,500
27 Nirpania Dhura, top of Pass, (estimated 3000 feet above No. 26,) ..	..	..	..	22 Sept. / 16 Oct.	7½ A. M. / 7 A. M.	198 / 198	52½ / 52	mean 7818	182	8000
(In Byáns.) ..	..	..								
28 Golam-Lá, (at the great rock.)								..	..	7500
29 Thin, hamlet, (left bank of Káli), (estimated 500 feet below No. 28,) ..	..	..	..	..	..	..	..	..	..	7000
30 Crossing of the Najangárh, (estimated 1000 feet below No. 28,)	..	..	..	..	..	..	..	..	..	6500
31 Confluence of the Najangárh with Kali River (estimated 1500 feet below No. 28,) ..	..	..	..	22 Sept.	sunset	198	61½	7861	39	8000
32 La-máre (on River bank,)									..	8250
33 Confluence of the Palangárh with Káli River (estimated 250 feet above No. 32,) ..	..	..	..	12 Oct.	2½ P. M.	197	62	8564	86	8650
34 Budhi village, 100 feet below.										10,500
35 Cheto Binaik, top of Pass, (estimated 1750 feet above No. 34,) ..	10,272	..	..	11 ,,	4 ,,	194	50	10,177	95	10,272
36 Garbiah village, ..										

No.	Name of Place.	Nature of observation for determining the Altitude.										Elevation above the Sea in feet.
		Trigonometrical by Webb.	Barometrical.		From Temperature of boiling water by H. Strachey.							
			Deduced Height.	Authority.	Date.	Hour.	Temp. of Boiling Water.	Temp. of Air.	Elevation deduced.	Presumed Error.		
37	Confluence of the Tinkar River with Kali, 100 feet above.	..	..	..	23 Sept.	4 P. M.	194½	60	10,046	54		9900
38	Changrew village, (Estimated 500 feet above No. 37.) ..	..	..	..	..	..	..	..	..	..		10,500
39	Confluence of Kali with Kunti-Yankti, supposed to be the same as Webb's "*Kalapani and Kali.*" ..	11,413	..	..	..	..	..	..	..	..		11,413
40	Mangdang, or Kunti River, ...	..	..	..	25 Sept.	4½ ,,	192	56	11,518	232		11,750
41	Kunti village, ...	..	..	..	26 ,,	4 ,,	190	57	12,762	238		13,000
42	Sangchungma, encamping ground above the River, ..	..	..	..	28 ,,	5 ,,	188	41	13,652	348		14,000
43	Phia-mungba, ...	..	..	..	29 ,,	5 ,,	185	33	15,363	387		15,750
44	Lánkpya Dhura, top of Pass, (estimated 2000 feet above No. 44, and 1750 feet above No. 45,) .. (In Gnari. Gugi. Pruang.)	..	..	..	..	..	..	..	..	..		17,750
45	Welshia, ...	..	..	..	1 Oct.	9 A. M.	184½	29	15,598	402		16,000
46	Bhaweti, at the Dharm-shála, ...	..	..	..	2 ,,	7 ,,	185	20	14,970	780		15,750
47	Lama-Choktan, (Estimated 250 feet above No. 46,) ..	..	..	..	..	..	..	..	..	..		16,000
48	S. E. End of Chujia Tol, (estimated same height as the Lakes,)	..	..	..	..	..	..	.	..	..		15,250
49	Pass between Chujia Tol and Amlang, (estimated 1750 feet above valley on either side,) .. (In Gangri.)	..	..	..	..	..	..	..	..	..		17,000
50	Amlang, bottom of valley, ...	..	..	..	3 Oct.	Noon.	186	45	15,025	225		15,250
51	Jungbwa Tol, bottom of valley (estimated same height as No. 50), ...	..	..	..	4 Oct.	2 P. M.	186	54	15,291	166		15,250
								No. 55.	14,878			
52	Cho Lagan (Rákas Tal), level of Lake, ..	..	..	..	..	..	..	mean	15,084			15,250
53	Gangri Mountains, average Height (estimated 4250 feet above Lakes), ...	..	..	..	..	..		..	..	..		19,500

54 **Peak of Tise (Kailas)**, Estimated 1500 feet above the average of the Range, and 5,750 above the Lakes, ..	..	..	..	..	..	..	..	..	..	21,000
55 **Cho Mapan (Manasarowar)**, [deducting* 175 feet height of station above Lake,] (In Pruang,) ..	..	..	..	5 Oct.	3 P. M.	186	46 No. 52 mean	14,878* 15,291 15,084	166	15,250
56 **Momonangli** (Gurla), (Estimated 8250 feet above the Lakes, and 2500 feet above Kailas,) ..	..	..	..	..	..	..	..	..	..	23,500
57 **Pass** between the Lakes and N. head of Pruang valley, (Estimated 1000 feet above Lakes,) ..	..	..	..	..	..	..	..	..	..	16,250
58 **Baldak Dharmshala**, (Estimated about the same as Lakes.)	..	..	..	..	..	..	..	..	..	15,250
59 **Kardam Karh**, (Estimated 250 feet below No. 58, and Ditto above No. 60.) ..	..	..	..	..	..	..	..	..	..	15,000
60 **Camp in Ravine** next above the great Ravine of Toiyon,	..	..	..	7 Oct.	2 P. M	187	56	14,709	41	14,750
61 **Toiyon village**, (Estimated 250 feet below No. 60,) ..	..	..	..	..	..	..	..	..	..	14,500
62 **Bridge over Karnáli R.** between Toiyon and Taklakarh, (Estimated 200 feet below No. 61.) ..	..	..	..	..	..	..	..	..	..	14,300
63 **Confluence of Tidya-Chu** with Karnali, (Estimated 50 feet below No. 62,) ..	..	..	..	..	..	..	..	..	..	14,250
64 **Takla-karh**, summit of hill, (Estimated 500 feet above No. 63.) ..	..	..	..	..	..	..	..	..	..	14,750
65 **Maghram village**, (Estimated 250 feet above No. 63 and Ditto below No. 64,) ..	..	..	..	..	..	..	..	..	..	14,500
66 **Pala-Dúng**, (Estimated 500 feet above No. 65), ..	..	..	..	..	..	..	..	..	..	15,000
67 **Ningri**, Estimated 100 feet above No. 66, and 1,744 feet below top of Pass, ..	..	..	..	..	..	..	..	..	..	15,100
In Byáns.										
68 **Lipu Lekh**, top of Pass. [14* Oct. 1828: Vide Calcutta Gleanings of Science, April 1829,] ..	..	16,844* M		..	..	..	..	..	..	16,844
69 **Ravine entering left bank of Kali**, supposed to be Webb's [" Mandarin's Camp."] ..	14506	..	..	..	..	..	..	..	..	14,506
70 **Yirkha hamlet**, above Kalapani (Estimated 1500 feet below No. 69), ..	..	..	..	..	..	..	..	..	..	13,000
71 **Kalapani Bridge.** [Site* not identified as there are now three bridges over the Kali in this vicinity, but supposed to be not far below Yirkha.] ..	12742*	..	..	..	..	..	..	..	..	12,742

NOTE.—In the above Table, and in H. Strachey's Map and Journal,

W. Signifies *Webb.*
M. ,, *Manson.*
T. ,, Trigonometrical.
B. Signifies Barometrical.
b. t. ,, Boiling Thermometer.
? ,, Estimates by Eye.

******Note on the Construction of the Map of the British Himálayan Frontier in Kumaon and Garhwál, by Lieut.* H. Strachey.

My map is based on the *Indian Atlas*, Nos. 65 and 66; the cis-Himalayan parts of which, being the result of Mathematical Survey, I have copied exactly, with the following alterations and additions:

1. Some alteration made about the extreme north-eastern Káli in Byáns, the original being decidedly wrong.

2. Other occasional defects in the positions of small streams, villages, &c. here and there amended, from observation or information.

3. Glaciers inserted in many places: these for the most part show the general position merely as derived from information or distant view; approximation to the true size or figure being attempted only in the Gori Glacier above Milam in Jwár, from personal inspection.

4. Entry from information, of sundry inter-Himálayan passes between the several Alpine valleys of Kumaon: there are doubtless many more of these remaining to be mapped in northern Garhwál.

5. All elevations of places to be found in Capt. Webb's book, reduced to sea level by the addition of 87 feet for the (supposed) height of his Calcutta comparisons above the sea; and the mean of all measurements given where more than one is recorded for any place. I have also got elevations of one or two places on the Alpine and sub-Alpine Káli (neither in Webb's book, nor in the map), from Vol. XII. Asiatic Researches, adding 72 feet for correction of the starting point from which they were derived trigonometrically in Webb's survey.

6. In south-eastern Jwár, I have marked in the map the Rálam valley, with the Pass from upper Jwár, Barjigánw-Dhura: the village of Rálam, and the river down to its confluence with the Gori at the entrance of Munshári: in northern Jwár details have been given of the intricate passes into Tibet.

The last mentioned additions to the maps of the "Indian Atlas" are mostly from my own observations, in June, 1846, which, though unaided by surveying instruments of any sort, will give an idea of the

* This map, a part of which only has been reduced to illustrate Lieut. Strachey's Journal, will be published hereafter, but it seems desirable that these remarks on its construction should be printed with Lieut. Strachey's other papers. —Eds.

ground preferable to the total blank left by the surveyors. I have obtained the elevations of a few places on the route from Bhuni to Rálam and from Milam to the Unta-Dhura pass, from the Barometric measurements given by Manson in Vol. XI. (part II. 1842, No. 132, Article III.) Asiatic Society's Journal, which, being without any comparison, I have reduced in a manner similar to that adopted for my own boiling observations. Manson makes his own measurement of Unta-Dhura "about 17,500 ft." but, according to my computation, it is not less than 18,200 ft. and the latter elevation agrees much better with my own personal experience of the pass and adjacent places, as also with Lieut. Weller's boiling observations.

I have also availed myself of the account given by Lieut. Weller (in Asiatic Journal, No. 134, 1843) of his journey to the Balch pass in May and June 1842, but his boiling observations were far too loosely conducted to give any thing in the shape of certain measurement for the elevation of places.

The most probable mistake here and there, doubtless must be much error, is in the longitude of Laptel and the Balch pass (as also Chirchun, &c.) which should, perhaps, be a mile or two further west, so as to make the Balch route to Dungpu more direct than that by Shelshel Sakh, &c., as the Bhotias declare it to be. I was not sufficiently aware of this till my map was past further correction, but the fault may easily be remedied in another copy. It will be observed in this quarter that I have made the British frontier include a good deal of ground unexplored and omitted by the surveyors: the valley of Laptel being so much more open and accessible to Gnari than to Jwár or to Painkanda, it seemed questionable whether it did not belong to Lhassa, but I have allowed its place in the boundary map to be decided by the flow of its water into Painkanda, so as to advance the British frontier to the crest of the Balch mountains and the low pass into Shelshel: the value of the ground itself is little or nothing to either party. Lieut. Weller then penetrated not "three day's journey into Chinese Tartary" (as a certain "pilgrim" supposed) but just up to the frontier line; Laptel has been visited by two or three other English travellers, but for venatic rather than geographical purposes.

Between the Jwár passes and upper Painkanda the map is compiled from the best information I could get of the Jwári Bhotias. The

Girthi valley has been once explored, I believe, by Manson and Irving in 18—? but without any record of results that I am aware of. My accounts of the Hoti valley between Laptel and Niti were very obscure and contradictory, and in this part of the map there may be great errorl.

The central part of Munshari is studded with a multitude of small villages and hamlets, the spring and autumn residence of the Jwári Bhotias, not half of which are shown in the Atlas No. 66. I have endeavored to supply the defect from information, and my map shows the approximate position of nearly all these places, but they are so crowded together that I was forced to omit the names of many of the hamlets.

In the trans-Himalayan part of my map, I have copied all of the Indian Atlas No. 65, which shows the explorations of Moorcroft and Hearsay in 1812, taken, I believe, from actual rough Survey of Hearsay's, though not so acknowledged on the map, and the positions there assigned to Gartokh and all the principal villages, rivers, &c. in the route of those travellers, remain unaltered up to longitude 81°, saving the direction of a stream here and there, which I had reason for knowing to be otherwise. East of that longitude, where the Atlas No. 65 terminates, is the result of my own explorations now recorded, including the lakes with the details of Kailás, and Gángri, the eastern and south-eastward sources of the Sutlej, the sources of the Karnáli, Momonangli, and the valley of Pruang, with its numerous villages. My survey was a very rough one, made with pocket compass (Smalchalder) and a watch: I took bearings of my course here and there, as I observed any particular change of direction, as also of Kailas, Momonangli, &c., from many different points, and I estimated my distances from noted times by supposed rate of progress according to nature of ground: from the road distances thus computed (at very moderate rates) I made liberal deductions for the map protraction, so that my errors are, I trust, always on the side of diminution rather than exaggeration. As even these rough methods of observation were often interrupted by night marches, &c. the survey is, of course, inaccurate in many respects; but, at the worst, I suppose that the place which I have assigned to Kailás, the furthest extremity of the survey, lies within a circle of 5 miles radius, described about the true position, and other parts accordingly. Kailás and Momonangli were placed from the average of a number of

intersections. In such rugged country no good flying-route survey is possible without constant latitudes: I regret that I had no instrument for getting them. I ascertained the deviation of my compass by bearings of the principal peaks of the Kumaon snowy range taken from Binsar (a high mountain near Almorah) compared with the protraction of the same upon the Atlas No. 66. This gave an average of some $3\frac{1}{2}°$ eastern declination, which I was obliged to apply to my survey of the lakes, &c. as I could get no means of checking my compass on the spot, in the whole course of my route from Almorah to Kángri; however inaccurate this process and its result may be, it is good enough to match the other operations of my survey.

My topography of Pruang from a nocturnal survey and bad information is far from perfect; some of the villages given in Angil's list are wanting, and the place of others doubtful, but it will give a fair idea of the position of the four principal places, Kardam, Taklakhar, and Jidi, the three *Khar* and Kajarh (Kocharnatti), of which the second Khar only is exhibited in previous maps under its Hindustani name of "Taklakot," and all the rest superseded by names and places purely fictitious.

It will be observed that in the trans-Himálayan part of my map (as also east of the Kali) I have given a rough representation of hills and mountains over extensive tracts of country which the Atlas (65 and 66) leaves all blank. These delineations of the mountains of Gnari, are such as I could make from partial and distant views, with scarcely any data for details or true positions of ridges, &c., but I thought it best to adopt this method, however inaccurate, because the other, contrasted as the blank is with the vivid representation of the cis-Himálayan mountains, tends insensibly but forcibly to convey the still more erroneous impression of a vast continuous plain on the north side of the passes, whereas the face of the country of Gnari is, for the most part, extremely mountainous.

It would have been interesting and useful (and may still be so, should the wanting material be hereafter forthcoming) to compare my delineation of the lakes, and adjacent places, Gangri, &c. with Hearsay's map of the same, but I have not been able to find any authentic copy of the latter, including the parts east of longitude 81°, which lie outside of the Atlas No. 65; the last mentioned map does indeed show the north-western part of Rákas Tal, with an effluent falling into the Sutlej be-

tween Tirthapuri and Kyunlung, but this at least, I have proved to be quite wrong, no part of the lake extending so far west, and the river in question being properly the Dárma Yánkti, rising in the Byáns Himálaya. In order to make this part of Hearsay's (?) map unite with my own, I have been obliged to bend down the portion of his route next east of Tirthapuri 2 or 3 miles to the southward, so as to enter the Gangri valley south of Kailás and Darchin, and the rivers crossed by this route have been similarly adjusted to meet the Lajandak Sutlej. In other respects Hearsay's map, as also Moorcroft's narrative, agrees very well with the information I have received from the Bhotias, and I have been able to identify many points of the route of those travellers with the Bhotias' descriptions. In the hilly ground between the Sutlej and Gartokh, I have merely had to insert the names of a few streams, encamping-places, &c. in Gugi, i. e. the valley of the Sutlej; I have added some villages and hamlets and corrected the names of others previously mapped, together probably all that exist (and more than are at present inhabited) from Mangnang eastward, many villages in Gangri were ruined by the plunder of the invading Sikhs in 1841, and have since been deserted. I could not get so much information about the country west of Mangnang, and the mapping of that part is comparatively defective, but I have obtained a material correction for the course of the Sutlej there, and the position of Tholing, hitherto wrong on all maps.

All the routes in Gnari, with the several encamping-places on them, are the result of most minute inquiries, where not personally explored. The road from Laptel viâ Shelshel to Dungpu, and thence back to Jwár by Chirchoon, I explored myself in June last, 1846, without surveying instrument however, and the present draft of it is subject to the possible correction suggested for the positions of Laptel and Balch, (viz. a mile or two more westward.) For the routes on information, I am indebted chiefly to the Jwári Bhotias (particularly to the family of the Patwári of Milam) who so far surpass the others in intelligence that I learned more from them about the lakes and Pruang than from the Byánsis, whose constant resort is to those places, and these parts of my map are perhaps as correct as they could be made without personal exploration.

A separate paper, accompanying this, gives all requisite particulars

regarding the determination of the elevations of places on my journey to the lakes, which are entered on that part of the map.

My orthography is always after the system of Sir W. Jones, and the Asiatic Society, but for Hunia names it follows the simple Hindustani pronunciation of the Bhotias, and not the complex Tibetan spelling, which can only be mastered by a critical knowledge of the language. I have had to ascertain de novo and re-write most of the names of places given in the Indian Atlas, the mistakes of which surpass belief; those which I have now given are, I hope, tolerably correct for most of the places in Kumaon and in Gnari, but I had not equal opportunity for revising those of Garhwál.

In my map I have made and explained the distinction between agricultural villages and mere temples and monasteries, places permanently inhabited and mere encamping-grounds, and all other requisite discriminations, the neglect of which simple but necessary details, together with the abominable kakography of names, has much impaired the value of the sheets in question of the Indian Atlas.

The separate sheets of the Atlas (Nos. 65 and 66 at least) though with scales, margins and other marks of completeness, omit to state their scale referred to a known standard, and their mode of projection. I had no access to authentic information on these points, till after the completion of my own map, and the latter was drawn, from one or two old copies of the Atlas, the paper of which had lost its proper size and shape, so that my scale is 25 miles to 6 inches, the nearest Aliqout measure that I could find to my originals, instead of 4 miles to one inch, as it should have been. My map differs from the Atlas also in its graticule, being on the conical development, which I adopted for its facility of execution (being without proper drawing instruments) and in ignorance of the projection applied to the Atlas. The latter I have since found to be based upon the most scientific elaboration, emanating from high authority, notwithstanding which it is palpably inferior to the simple geometrical process of the conical development, both in theoretical accuracy and in facility of practical application. My copies of the Atlas, sheets 65 and 66, gave the length of the meridional arcs sensibly in excess of the truth (like the Tables of Baily); in my map I have reduced them to the lengths given in the tables of Pearson, &c. (after Lambton). In other respects however my map does not pre-

tend to any accuracy of execution, for which I had neither the requisite mechanical appliances nor sufficient time, but all the cis-Himálayan part of it traced from the Indian Atlas is quite correct enough for practical purposes: the trans-Himálayan ground, nowhere fully explored or accurately surveyed, is of course open to much correction.

Description and Analysis of a large mass of Meteoric Iron, from the Kurruckpore hills, near Monghyr. Presented to the Museum of the Asiatic Society, by Captain W. S. Sherwill, *B. N. I. By* Henry Piddington, *Curator Museum Economical Geology.—With two Plates.*

The Museum is indebted for this magnificent specimen to our valued member and active contributor, Captain W. S. Sherwill, of the Revenue Survey.

Upon his first visit to the Museum some months ago I showed this gentleman amongst our mineralogical treasures and curiosities, the Aerolites, and next to them our specimens of meteoric iron, upon which he remarked that he had a large lump of iron "*of some kind*" which had been found in the Rajmahal hills "*a good deal like that.*" I begged of him forthwith by all means to send me at least a specimen of it, which he did, and my conjecture (from his account of its qualities, such as toughness, &c.) that it might prove a mass of meteoric iron, were, after some baffling in the research which mineralogical chemists will understand from the chemical details which follow, was crowned by indubitable proofs that it was so! Captain Sherwill, when recently here, at my request desired a friend to send the whole mass down, and the Society now possesses this most valuable specimen, which I proceed first to describe, as to locality and physical properties, before detailing my examination of it.

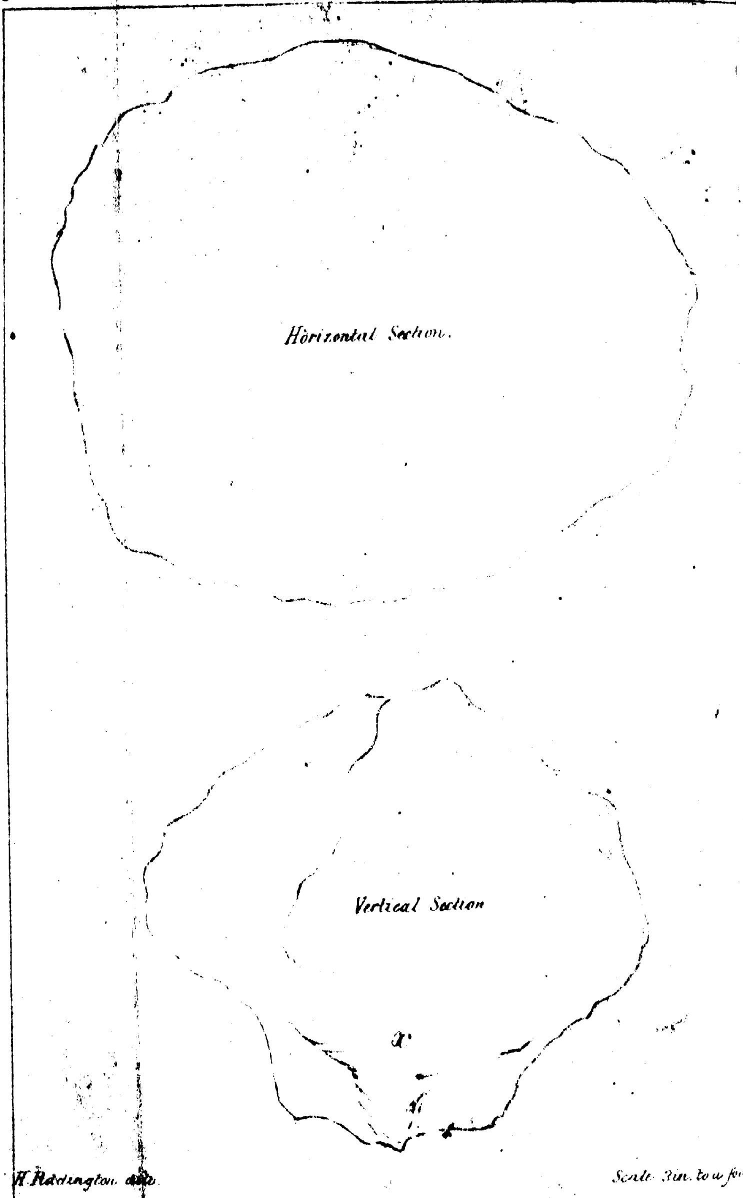
Locality.

Captain Sherwill's note is as follows:

"*The accompanying mass of iron, supposed to be of meteoric origin, was found imbedded in the soil on the top of the forest-clad Kurruckpore hills near Monghyr. It had been exhumed and worshipped for many years by the hillmen.*"

B Hastings del.

Mass of Meteoric Iron from the Kurruckpore Hills Weight 160 lbs.
Presented by Captn. W. S. Sherwill 66th B.N.I.



Horizontal and vertical Sections of Captn. Sherwill's. Mass of Meteoric Iron shewn in Plate XIX.

He added in conversation that the gentleman who first obtained it was an Indigo planter, but omitting to note his name, I have not been able to make further enquiry as to any traditions about it. Captain Sherwill also mentioned that there are native forges in the vicinity, but he has sent us some of their ores, which are common brown iron ore, and of their smelted masses, which are quite different from the specimen, and this would not have been worshipped without some very special reason for it. Our mass is also, to say nothing of its physical and chemical properties, of a size and weight far beyond what any native forge could produce, at a cast, and moreover, is most certainly not cast iron. Nevertheless before submitting it to the scientific world as meteoric iron, we are bound to omit no proof direct or collateral, that it is really and truly such, and this will be, I trust, my excuse, if thought prolix.

I proceed now to describe our specimen, noting in parallel columns coincidences from Mr. Mornay's description of the great Brazilian mass, (*Mornay and Wollaston, in Phil. Trans.* Vol. CVI. *for* 1816,) Pallas' description of the mass of Siberian iron, which is now known to be meteoric, from the French edition of his voyages, (Vol. VI. p. 346, and following,) and from several descriptions and notes on meteoric iron, from various sources in the Quarterly Journal of Science, which I shall note as I proceed.

I.---*External appearance.*

Our specimen is a block of a somewhat conical, oviform disk-shape, standing, as it were, on a sort of foot, as in the plates,* but it must be supported by a block of wood not to fall forward. It is slightly truncated at both ends. Its colour is, in some parts, mostly at the more prominent knots and bosses, a chesnut brown, in others and in the numerous cellular cavities with which it is in many places honey-combed, it is more of a dark iron-slag colour. Generally it resembles in colour a mass of some of the more compact brown iron

The mass of upwards of 3000 lbs. in weight from the banks of the Red River, Louisiana, and now in the New York Institution, is described as "shape irregular, inclining to oviform, much broader at bottom, where it has rested on the earth, than at the top, inclining somewhat in the manner of a cone," Quarterly Journal, Vol. IX. p. 193.

Mr. Mornay's description and drawing of the Brazilian mass gives also a sort of foot on which it stands as well as a tail behind. He says also that the foot is about six inches in height; colour of the

* Plate XXIX. is a perspective view of it, Plate XXX. are vertical and horizontal sections to scale.

ores than anything I can liken it to; but they are rarely or never honey-combed. Small water-worn specimens of this last named mineral sometimes are so, and one of these magnified, or a huge lump of dark coloured ferruginous *Kunkur*, gives one the best mineralogical notion of the appearance of our large specimen. If seen in the bed of a torrent it would indeed have been thought a mass of water-worn ironstone, if no accidental friction had shown its bright metallic streak, which is apparent upon the slightest scratch; except at the few scoriaceous parts.

When closely examined there are seen to be parts which are evidently more scoriaceous and cellular in appearance than others. In a very few places minute fragments or patches of a yellow and reddish or orange-coloured felspar or sandstone-like mineral, with a slight gold-coloured lustre in a strong light, are found imbedded and evidently fused in, with the scoriaceous part; sometimes having a very little green glassy mineral like broken bottle glass fused around or close to them; both are highly brittle, and in such minute quantities, and so imbedded in the mass that it is only by careful poring over it with a magnifier that they are detected; and it is impossible to do more than to obtain minute blowpipe fragments, from which it however appears clearly that the glass is Olivine, being just fusible on the edges, and first discolouring, and then so far disintegrating as to fall to pieces when touched, after two or three days' digestion in muriatic acid; which then gives the reaction of peroxide of iron.* The Brazilian specimen that of a chesnut, but with thick flakes of oxide below.

The glossy surfaces of his block are not smooth, but slightly indented all over, as if hammered with a rather large round-headed hammer.

The Siberian specimen, Pallas thinks, was originally covered with a rough ferruginous (oxided?) crust which had been broken off to obtain pieces of it.

The brown colour of the surface of the block is merely a very thin coat of rust, for the slightest scratch with a knife produces a bright metallic streak.—PALLAS' VOYAGE.

* The olivine of meteoric stones does not gelatinise like that of basalt and other volcanic specimens, (See Vol. XIII. of Journal, p. 884, Examination of the Kandeish Aerolite.) Specimens are too small and scarce for us to ascertain what this is owing to.

yellow sandstone-looking mineral when digested in muriatic acid loses its colour, and the acid gives traces of iron. The mineral is then a compact dead white-coloured mass, like milk-quartz, and before the blowpipe it proves to be quartz without any trace of alumina or magnesia.

The lower or foot part of the specimen is much more corroded than the upper part (as if it had oxidated more rapidly by lying on the damp ground?) In some of the cavities a lining of a pitchy lustre is to be detected, but this does not appear to be the remains of nests of crystals, as in the Brazilian and Siberian specimens.

Our mass having laid apparently in an exposed situation in a bungalow, has yet many specks of white-wash upon it, which will not scrub off, and as to use an acid would I fear alter the fair appearance of the specimen, I have thus preferred to allow them to remain.

II.—*Dimensions, Weight, &c.*

The dimensions of this mass of iron taken with callipers, are as follows:

	Inches.
Extreme length............	15
Extreme breadth, ...	$12\frac{3}{8}$
Greatest thickness from the foot to the bosses at the vertex, ...	$9\frac{7}{8}$
Average thickness, excluding the foot, about......	$8\frac{4}{8}$
Thickness at the small end,	$5\frac{1}{8}$
Breadth at the small end, ..	$7\frac{1}{8}$
Diameter of the foot, which is somewhat circular,....	$7\frac{3}{8}$
Diameter of the foot at the base, ...	6
Foot projects from the lower part about	$1\frac{3}{8}$

Its weight, carefully taken for me by Mr. Laidlay, in a good balance, is 1 factory maund, and 36 seers, or 156½ lbs. English. I have cut off a small piece, and Captain Sherwill told me he had taken a piece or two, besides the one he first sent down, so that altogether its original weight must have been close upon 160 lbs. English.

The weight of the Elbogen mass of Meteoric Iron in the cabinet of the Emperor of Austria at Vienna, is 141 lbs. German, or 174 lbs. English.

III.—*Internal Structure and Appearance.*

I have not yet been able to detect in our specimen any decided crystals. On one splinter I certainly found a crystallized facet, and traces of them are to be seen frequently, but nothing sufficiently distinct for us to speak of it as being crystallised; however, this may exist, and be partially destroyed by the violent action of separating any fragments from the mass.

When a portion of the metallic part is broken or cut off, it is of a bright platina-white colour, and when polished and acted upon by a dilute acid, it exhibits the damask watering known to be a characteristic of meteoric iron. Its fracture may be called very sharply uneven, and cellular, exactly resembling that of a tough rod or bar, of iron which has been torn asunder; and it almost pricks the fingers upon handling it roughly. It is full of small cellular cavities, which give it almost a spongy appearance in some places.

Pallas, p. 350, says of the Siberian mass that,—

The crust being taken off, the rest of the mass is a soft iron, white at the fractures and full of holes like a coarse sponge, and he goes on to describe the olivine with which the cavities of it were filled.

The Santa Rosa and other masses are also described by Bossingault, (Quarterly Journal Science, Vol. 17, p. 395,) as cellular and without a vitreous coating—malleable, of a granular structure and easily giving way to the file; of a silvery aspect, and of Sp. Grav. 7.3. Another mass at Santa Rosa is described as cellular, very hard to the file, malleable, of a silvery aspect, and of a fracture resembling tilted cast steel. Another mass is said to have exhibited small facets in its fracture, malleable and of a silvery lustre.

The damasking appearance is stated in the Quarterly Journ. Vol. 5, p. 372, (upon what authority is not given) to have been first pointed out in Germany, and to have been found in all the well known specimens of meteoric iron, as well as in the grains found in meteoric stones, but as not to be found in some of doubtful origin.

IV.—*Magnetism.*

I have not been able to detect any thing approaching to polarity in our mass. It attracts like common iron both ends of the needle indifferently.

Dr. Wollaston failed also to find any polarity in Mr. Mornay's fragments.

V.—*Hardness, Toughness, &c.*

It is by no means hard, being readily indented or flattened at the bosses like any soft iron, and yielding easily to the file. It is however of extraordinary and almost incredible toughness, so that, while it yields to the cold chisel, or steel wedges, to a certain extent, it is half a day's work for a native carpenter with steel wedges to cut off a small piece from the metallic part. In the few scoriaceous parts pieces are much more easily detached, but when these are pulverised, the grains and minute portions of the metallic iron amongst them, are beaten into tough flat disks.

It has been found by Messrs. Jessop and Co. to forge easily at a moderate heat and a forged piece is exhibited.

I had provided myself with a sledge hammer, and tools for cutting off some specimens of the iron, but it was with the utmost difficulty, I could detach the few small pieces which you have seen. —*Mornay.*

Though Pallas in the preceding page, (that is, his French translator) has, as just quoted, called the iron soft *(doux)*, he now says in the next page, 351, using the words *dur* and *compacte* to express tenacity and toughness, that, The iron is so hard and compact *(dur et compacte)*,* that three or four smiths have employed ten and twelve men with steel wedges, and sledge hammers to cut off a piece, which weighed at most two pounds. In one instance only did they succeed in cutting off a piece, which weighed about a pood, (36 lbs. English.)

Remarks on the foregoing physical characters.

Amongst these the shape of our Aerolite is certainly the most noticeable, and we are at first sight much puzzled to account for the foot-like appendage, which, as was naturally enough at that time supposed by Mr. Mornay in the Brazilian mass, we are inclined hastily to suppose a *ramus* or branch attaching it formerly to some larger mass. Mr. Mornay however showed for his specimen by digging under it, that there was *no* mass or vein to which it could have been attached, and improved chemical research now satisfies us that there is no terrestrial native iron which contains Nickel and Chromium, and on this conclusion we rest in addition to other collateral evidence for the meteoric origin of our's.

But the foot still remains to puzzle us.

* The proper words are *tenace, tenacite.*

We first attribute it to the more rapid oxidation of the part in contact with the soil, but the legend says it was *dug out* of the ground; so that while it was interred, if it was altogether so, the whole would have been equally subject to oxidation. When dug out and placed as an object of worship it probably was kept under cover; but the expression and the account are altogether too vague to serve us as data from which to deduce conclusions. It is doubtless possible (though but remotely so) that the foot may have been formed by the gradual oxidation of the lower part, yet this we should think—supposing the mass to have been originally an egg-shaped lens, and as compact below as above—would have gone on equallly over *the whole* of the lower surface, instead of one part of it, and also at the large end (at *e* in Plate I.) but it has not done this at all, and so, unless we also suppose unequal tendency to oxidation, this process does not satisfactorily account for its present shape, and this moreover, we cannot fairly suppose, because at present the foot is as hard and as metallic as any other part. One supposition only remains, i. e. that there might have been more of the scoriaceous or earthy parts below, which have separated in time from the mass, and the traces of these parts *are*, it is true, more frequent below and at the rim of the disk than on the upper part. Yet this is very poor aid to prove that there ever was so much more of it, as this supposition demands, and it seems now as little liable to oxidation and decomposition as any other part, and if we admit this fully, still we have *the* question of why the metallic nucleus (for such it would then be) has assumed this shape? which is in fact coming back to our original enquiry.

I think one way of accounting for it may be this—

If we suppose a ball of semi-fluid matter (whether rendered so from heat or otherwise) to fall vertically to the earth's surface without breaking into fragments, such a mass would, it is clear, form a circular and lenticular disk, which would be more or less flattened at the lower surface: for the motion of the mass would be then derived from a single force, the earth's attraction, and the resistance would meet it in a line directly opposed to that motion.

But if we supposed our semi-fluid mass to fall in any line deviating from the vertical, as in one for example like that of the arrow in Plate XXIX, we have then altogether a new state of things; for here are first two forces in the mass, the vertical (from attraction) and the projectile force,

and then the resistance of the earth, which no longer meets the other forces in their direct path. If we next suppose the mass to fall diagonally upon a tolerably soft soil—and our mass, if semi-fluid, must have done this, for if it had fallen upon a hard one it would have been broken to pieces, unless indeed it fell in a solid state from the heavens, which we do not assume*—we can suppose it also to be *driven* into the earth for a certain distance till the vertical part of the force was exhausted, but during this process the projectile force would, particularly for the part above ground, be urging forward the remainder of the mass, so as upon its final cooling to produce a disk somewhat like what we see in our specimen, and place the centre of gravity somewhere in a line about that which I have marked at *a. b.* in Plate XXIX.

In the course of this cooling we might also find that one part of the mass, being more rapidly cooled by the contact of the earth, would be more porous, which our mass is; and that the lower and front part of it (the front part in relation to its supposed motion) might be drawn out into a ridge-like prominence, which *is* the case with our specimen also; and I have marked this ridge, which however is sharper and better defined than there shown, in the vertical section at *x.* in Plate XXX.

With means at command it might perhaps be possible, as by projecting a ball or mass of softened fusible metal on a yielding soil at various angles, to test the truth of all this, which I beg to be understood as submitting as a mere theory, but even if we were to obtain a solid somewhat in the form of our specimen, we should merely thereby increase the probabilities that this was really the cause of its assuming this shape; for, after all, its original form may have been nearly what we see it, and upon the hypothesis of these bodies being originally projected from the Lunar Volcanoes, we may suppose it to be a huge lava-drop† detached from some mass of botryoidal concretions, and blown into the sphere of the earth's attraction. The coincidence of our mass with the Brazilian one in having a foot (though it wants the *tail* which Mr. Mornay delineates) is too remarkable to be passed over. I have been unable to

* There are instances of stony Aerolites being found in a soft state immediately after their fall, but I do not recollect any of the metallic ones being so found. Nevertheless we may fairly assume that, as less heat is required, the probabilities are that they also fall in a semi-fluid state.

† A French writer would have a better word, "*une larme de lave,*" or lava *tear.*

find a copy of Bongainville's voyage, and to consult Boussingault's work, if they give any description of the forms of the masses noticed by them; and it is one of the great difficulties which all colonial research labours under, that we are either wholly deprived of references or can find only the brief and abridged notices to which scientific periodicals are necessarily limited, and which for some part of the matter in hand are wholly insufficient for our purpose.

Since this was written I find in the Quarterly Journal of Science, Vol. 12 for 1822, p. 330, an account of some meteoric stones, one of which fell in Courland, on the banks of the Kolupschen Lake in the presence of some labourers, and was hot enough to burn their hands when they touched it. It is said to have penetrated a foot and a half into a dense dry clayey loam, and that its shape when entire *resembled a rounded anvil, of which the narrow end was undermost.* This is not very explicit, but it serves to show that there may be a tendency to these elongated anvil-like forms either with or without a foot. The Chinese give all manner of fantastic names to the stones recorded in their annals to have fallen from the heavens, of which some it is known are iron, such as "anvils, hammers, nails, hatchets, &c." and our own name of thunder*bolt* and the German *Donneraxt* (Thunder-axe) seem related to this sort of popular record of these phenomena.

I put any classical conjecture with diffidence, but a curious question arises here. Is this falling of *anvil*-shaped masses from heaven (in the case of our Indian specimen, and the Brasilian and Courland ones too, they are of iron) the parent source of the myth of the Lemnian Vulcan's being hurled from heaven by Jupiter on the island of Lemnos? where the anvil-God was "received" by the Sintians? as described by Homer, Book I. l. 593.

> Κάππεσον ἐν Λημνῳ ὀλίγος δὲτι θυμὸς ἐνῆν.
> Ἔνθα μέ Σιντιες ἄνδρες ἄφαρ κομίσαντο πεσόντ α.

Literally,

> "Till upon Lemnos I fell, and but little of breath was remaining,
> When of the Sintian men I was received, at my falling."

The paraphrase of Pope being inexact I do not quote it. The little of breath (θυμὸς life, soul, ardour, &c.) may well be understood as the mythic amplification of the original fact that the Vulcan (the meteorolite) was nearly cold when he reached the ground and was approached;

and *certes*, our Indian Sintians of the Kurruckpore hills, "received" and comforted their Godling, in the worship they paid to him, and perhaps also have their legend and myth respecting him, if we could only obtain it? More than one of these wonderful bodies were worshipped by the ancients and have been even held to be personifications of the heathen divinities. The thunderstone in Crete, regarded as the symbol of Cybele; the Ancyle or sacred shield of Numa, and "the mother of the Gods" at Pessinus, are all cases which will readily occur as fortifying my conjecture (see Art. Meteorolites, Ure's Dict. &c.) Cicero (De Natura Deorum, Lib. III. par. XXIII.) describes four well known Vulcans; the Athenian, Egyptian, Lemnian and Menalian or Liparian Vulcans.

Chemical Examination.

The examination of the siliceous specks and olivine I have already described.

The specific gravity of a small specimen of the metallic part, carefully chosen to avoid cavities, was, ... 6. 76

The specific gravity of the forged bit is,.................. 7. 31

Scoriaceous part,...................................... 4. 03

I have satisfied myself by repeated and careful examination that our specimen contains

Iron,
Nickel,
Cobalt,
Chromium,
Silica,
Alumina,

and traces of Arsenic and Selenium.

But these again are most variable in their presence and amount, so that no two assays will give like results, and thus the whole contradicting each other, as it were, renders it impossible to give a quantititative analysis either of the metallic or the scoriaceous parts in any degree satisfactory.

I estimate therefore from several trials that the metallic part contains about

Metallic iron,	87.	00
Silex,	11.	50
Alumina and Loss,	1.	50
	100.	00

With traces of Arsenic.

The Scoriaceous part

Metallic iron,	77.	00
Silica,	17.	
Aluminum,	1.	50
Cobalt,	3.	20
Nickel,	1.	
Chromium,		50
Arsenic and Selenium,	Traces.	

It seems at first sight to be treating the subject loosely to give only these approximate quantities, but it was only after long and repeated and most careful work that I could be satisfied of what I have above announced, and that it was wholly impossible to take any one analysis as representing the average constituent parts of the specimen; but I do not regret my labour, for it enables us to explain how it is that chemist after chemist in Europe, and these men of the first talent, have successively differed in their results, or have found new products, such as the Chromium, in the same specimen in which others had failed to detect it. It is evident to me that they obtained assays from different parts of the specimen* and have thus differed, as I again and again found I did from myself, to my no small surprise and perplexity.

And philosophically considered this is what (so to speak) *should* really occur, for if we admit these meteorites to be revolving round us as their primary, and thus to be, for us, a sort of satellites, we might imagine that if the earth, when *it* too was an incandescent asteroid had fallen, like our specimen, in upon some huge siderial primary, and had been there "examined and reported upon" that a chip from about the

* And indeed this is a matter almost of course. The small specimens brought from foreign countries and the minute fragments obtained from great museums as special favours must all have been very imperfect averages of the whole of any large mass.

Cape of Good Hope might have given different results from a splinter off Cape Comorin; and a knob from one of the Andes, with a vein of silver in it, might differ widely from a fragment of Madagascar or Siberia or Sussex. When our specimen was an incandescent spheroid (assuming it to have once been so), the scoriaceous and purely metallic parts may have made spots and districts on the nucleus as marked as the various formations of our globe.

In the examination of both I find a minute portion of the insoluble residuum described by Boussingault, (Journal of Science, Vol. 17. p. 395,) which is in the form of a black dense granular powder,* and in ours is wholly insoluble in nitro-muriatic acid, and even fusion in caustic potass alone has very little effect upon it. The only menstruum which will properly act upon it, being a mixture of caustic and nitrate of potass, which by long fusion dissolves out the chromium as a chromate of potass, when the powder is first carefully pulverised, and the heat kept very high. By the blowpipe the chromium is readily detected by microcosmic salt on the platina wire, the iron separating as a metallic bead, and the assay bead remaining dull from the silica in the compound. It appears to be a silico-chromate of iron, but with such minute assays it is impossible to say more at present of such a refractory compound than that it contains silica, iron and chromium, the silica and iron being in large proportions and the chromium in a very small one. It may possibly be a siliceous sub-chromate of iron?

With reference to the presence of the arsenic (which was distinctly ascertained by Marsh's process), and to what I have said above as to the successive oversights of first-rate chemists, the following extract from a notice of M. Walchner entitled "Observations on the general distribution of copper and arsenic" in the *Comptes Rendus Septembre*, 1846, which I take from the Quarterly Journal of the Geological Society may not be out of place.

After affirming the presence of copper and arsenic in many iron ores, mineral springs, soils, rocks, &c. the author goes on to say,—

"It now remained to demonstrate that these metals were equally

* I think also so described by some other chemist, but I cannot now find the reference.

contained in meteoric iron ores,* my first experiments were made on the meteoric iron of Pallas, well known and repeatedly analysed by distinguished chemists, and in reality I have found in it both copper and arsenic, also in the Mexican meteoric iron of Yuanhuitlan, near to Oaxaca, brought home by my colleague M. Sommerscht principal engineer of mines; in a meteoric iron from Tennessee described by M. Troost in Silliman's Journal; and finally in a fragment of the great mass of meteoric iron, deposited in the museum of Natural History of Yale College in Connecticut. Consequently it is not only at the surface of the earth that iron is mixed with copper and arsenic, but also in the solid portions of other celestial bodies."

Copper I have as yet failed to detect in our meteorite, but I should be far from affirming that it does not exist in it.

H. Piddington.

The Aborigines of Central India.—By B. H. Hodgson, *Esq.*

At the close of last year I had the honour to submit to the Society a summary view of the affinities of the sub-Himálayan aborigines. I have now the honour to submit a similar view of the affinities of the aborigines of Central India. The extra copies of the former paper which were sent to me by the Society I forwarded to Colonels Ouseley, and Sleeman, to Major Napleton, Mr. Elliot of Madras, and other gentlemen, with a request that they would get the vocabulary filled up from the languages of the several aborigines of their respective neighbourhoods. The three former gentlemen have obligingly attended to my wishes, and I am assured that Mr. Elliot also is busy with the work. Of the seven languages which I now forward the comparative vocabulary of, the three first came from Chyebossa, where Colonel Ouseley's Assistant, Capt. Haughton prepared them; the 4th and 5th direct from Col. Ouseley himself at Chota Nagpur; the 6th from Bhaugalpur pre-

* M. Rammler of Vienna has found the arsenious acid in the peridot of the meteoric iron of Pallas (Pogg. Annal, 1840, No. 4.)

pared by the Rev. Mr. Hurder; and the 7th from Jabbalpur where Colonel Sleeman's principal assistant drew it up for me.

The affinities of these tongues are very striking, so much so that the five first may be safely denominated dialects of the great Kól language; and through the Uráon speech we trace without difficulty the further connexion of the language of the Kóles with that of the "hill men" of the Rajmahal and Bhaugalpur ranges. Nor are there wanting oblious links between the several tongues above enumerated—all which we may class under the head Kól—and that of the Gónds of the Vindhia whose speech again has been lately shown by Mr. Elliot to have much resemblance both in vocables and structure to the cultivated tongues of the Deccan. Thus we are already rapidly approaching to the realization of the hypothesis put forth in my essay on the Koch, Bodo and Dhimál, to wit, that all the Tamulians of India have a common fountain and origin, like all the Arians; and that the innumerable diversities of spoken language characterising the former race are but the more or less superficial effects of their long and utter dispersion, and segregation, owing to the savage tyranny of the latter race in days when the rights of conquest were synonymous with a license to destroy, spoil and enslave. That the Arian population of India descended into it about 3000 years ago from the north-west, as conquerors, and that they completely subdued all the open and cultivated parts of Hindostan, Bengal and the most adjacent tracts of the Deccan* but failed to extend their effective sway and colonization further south, are quasi historical deductions† confirmed daily more and more by the results of ethnological research. And we thus find an easy, and natural explanation of the facts that in the Deccan, where the original tenants of the soil have been able to hold together in possession of it, the aboriginal languages exhibit a deal of integrity and refinement, whilst in the north, where the pristine population has been hunted into jungly and malarious recesses, the aboriginal tongues are broken into innumerable rude and shapeless fragments. Nevertheless those fragments may yet be brought together by large and careful induction; for modern ethnology has actually accomplished

* Telingána, Gajerat and Maharáshtra, or the Maratta country.

† Brachmanes nomen gentis diffusissimæ cujus maxima pars in montibus (Ariana Cabul) degit, reliqui circa Gangem. Cell Geogr.

elsewhere yet more brilliant feats than this, throwing upon the great antihistoric movements of nations a light as splendid as useful. But, if I hold forth, before hand, the probable result of this investigation in the shape of a striking hypothesis, in order to stimulate the pains-taking accumulator of facts, and even intimate that our present materials already offer the most encouraging earnest of success, I trust that the whole tenour and substance of my essay on the Kóch, Bódo and Dhimál will suffice to assure all candid persons that I am no advocate for sweeping conclusions from insufficient premises, and that I desire to see the ethnology of India conducted upon the most extended scale, with careful weighing of every available item of evidence that is calculated to demonstrate the unity,* *or otherwise*, of the Tamulian race.

* This unity can of course only touch the grander classifications of language, and be analogous to that which aggregates, for example, Sanscrit, Greek, Teutonic and Celtic.

Comparative Vocabulary of the Aboriginal languages of Central India.

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Air	Hoiyo	Hóyé	Hóyó	Tháká	Hóyóh	Táké. Táphé	Báribá ítá
Ant	Múí	Múni	Múé	Póh	Múnj	Pók	Patté
Arrow	Sarh	Sarh	Sarh	Chár	Sáár	Chár	Jiyatúr
Bird	O'é	Chéné	Chéné	O'rak	Uré	Púj	Ittá
Blood	Myún	Myún	Myún	Khéns	Myún	Késú	Nattúr
Boat	Dúngá	Dúngá	Dúngá	Dóngá	Dóngá	Návé H	Dóngó
Bone	Jáng	Jáng	Jáng	Khóchal	Jáng	Kochal	Hára
Buffaloe	Kérá	Kará	Kérá	Mánkhá	Bhitkil	Mángé	Háliyá
Cat	Bilai H	Púsí	Bilai H	Birkha	Pússí	Bérgé	Bílal
Cow	Gúndi	Gai H	Gai H	Udá	Urí	Oi	Dhóriyal
Crow	Ká	Kahú	Kóvá	Khákhá	Kóvá	Káké	Káwá
Day	Súgi, Má	Sing. Má	Din H	Ullah	Sing	Diné H	Patti
Dog	Sétá	Sétá	Sétá	Alla	Sétá	Allay	Naï
Ear	Lútúr	Lútúr	Lútúr	Khebda	Lútúr	Khetway	Kavi
Earth	O'té	O't	O'té	Khékhél	Wathé	Kékal	Dharti S
Egg	Pitú	Billi	Pito	Bí	Billi	Kírpan	Méj
Elephant	Háthi H	Háthi H	Háthi	Háthi H	Háthi H	Ati H	Yéje
Eye	Mét	Mét	Mét	Khán	Méd	Káné	Kank
Father	Apúng	Bábá	Bábú	Bábé	Apúng	Abá	Wáwó
Fire	Sengel	Sengel	Sengel	Chik	Singil	Chiché	Kis
Fish	Hákú	Hakú	Hái	Injo	Hákú	Min	Min
Flower	Bowh	Búhá	Baha	Phúp	Baha	Púp	Phúl H
Foot	Kátá	Súptijánga	Kata	Dappé	Kata	Kév	Kalk
Goat	Méram	Méram	Méram	E'rá	Méram	Cré	Bókra H
Hair	Ub	Ub	Ub	Chúttí	Up	Tali	Róbáng
Hand	Thí	Thí	Thí	Khékháh	Tibi	Sésú	Kaik
Head	Bu	Buho	Buho	Kúk	Bóhú	Kúpé	Talla
Hog	Súkri	Súkri	Súkri	Kiss	Súkri	Kís	Paddí
Horn	Dring	Darring	Derring	Márag	Daring	Márg	Singh H
Horse	Sadham	Sadham	Sadham	Ghoro H	Sadam	Goro H	Kóndand ?
House	O'á	O'rá	O'rá	Erpá	Uráá	Avá	Rón
Iron	Médh	Mérhad	Mérhd	Panná	Marhan	Lóhá H	Kachchi
Leaf	Sákam	Sakam	Sikkam	Atkhá	Sikam	Atgé	Akí
Light	Maskal	Marsal	Tetaytúrra	Billi	Marsa ?	Avéli	Bérachí

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Man	Hó	Horh	Horro	Alla	Horl	Málé	Mánébábá mawsal
Monkey	Sarrha. Gári	Hanú. Gári	Gari	Bandra H	Bandra H	Múgé	Bandara H
Moon	Chándú H	Chando H	Chandú H	Chando H	Chandú H	Bilpé	Chanda H
Mother	E'áng	I yo	Mai H	Ayyo	E'ngan	Ḱyá	Aval
Mountain	Búrú	Búrú	Búrú	Partá	Búrú	Tóké	Dongar
Mouth	Ḱ	Mocha	Alang	Bái	Mocha	Soro	Udí
Moschito	Sikí	Sikri	Lútí	Bhúséndi	Bhúsúndi	Minko	Misi
Name	Nútúm	Nútúm	Númú	Nám H	Natúm	Námi H	Battí paról
Night	Níndhá*	Níndhá	Nídhá	Mákhá	Nidak	Máké	Narkaát
Oil	Súnúm	Súnúm	Súnúm	Issúm	Súnam	Isgné	Níng
Plantain	Kodal	Kaira	Kodal	Kérá H	Kélá H	Kalvi	Kérá H
River	Garra	Garra	Garra	Khár	Garra	Caret	Dóndá
Road	Horra	Hor	Horren	Dáhári	Hórah	Sarké H	Sarrí
Salt	Búlúng	Búlúng	Búlúng	Békh	Búlang	Béké	Sabbar
Skin	Ur	Harta	Ur	Chapta	Harta	Chámé S	Tól
Sky	Sirma	Sirma	Rimmil	Mírkhá	irma	Sarángé	Bádúr ? H
Snake	Bing	Bing	Bing	Nír	Bing	Nér	Tarás
Star	E'pil	Ípil.	Ípil	Bínká	Ipil	Bindéké	Sukú
Stone	Dirri	Dirri	Dirri	Pakhná	Diri	Chaihé	Tóngí
Sun	Singi	Sing marsal	Singi	Dharmi†	Singi	Bér	Súraj H
Tiger	Garúmkúla	Kúla	Kúlá	Lakhrá	Kúlah	Sad	Púlli
Tooth	Dáthá H	Dátha	Dátta	Páll	Dátá H	Páll	Palk
Tree	Dárú S	Dáré	Dárú	Man	Dárú S	Man	Mará
Village	Hattú	Athú	Hathújé	Padda	Hátú	Kép	Nár
Water	Dáh	Dáh	Dáh	Um. Chéïp	Dhá	Ḱm	Yér
Yam	Merúmtosang	Dá sáng	Sángá	Ḱlú H	Ḱrú H	Caret	Náska kángda
I	Aing	Ingé	Ing	Enan	Ing	En	Mánú
Thou	Um	Umgé	Am	Níen	Am	Nin	Imma
He, She, It	Ini	Uní	Ini	Asán	Inni	Ḱth	Caret
We	Caret	Caret	Caret	En	Allégé	Nam. Om	Caret
Ye	Caret	Caret	Caret	Ḱsú	Inkoghí	Nina	Undé
They	Caret	Caret	Caret	Caret	Ḱnkó	Ḱsabar. Ḱwar	Caret
Mine	I yan	Ingréá	Inya	E'nghi	Jhátaná	Ongki	Nává ángdo
Thine	Ummá	Ami	Ummá	Níenghi	Amátaná	Ningki	Niávútriánd

* A misapplication probably of the Hindi word for sleep or sleepy.

† Sanscrit? and implies that the Sun is worshipped.

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
His	Ini	Unéá	Aigé	Ásghi	Annerá tana	Áhiki	Oná
Our's	Alléá	Alléá	Abúsaban	E'mhí	Ahúá tana	E'mki. Námki	Mábaí
Your's	Appéá	Appé	Caret	Ássghi	Apiá tana	Nimki	Niá hillé
Their's	E'nkóá	Unkúré	Caret	Caret	Ankóá tana	Ásá bériki	Oná ánd
One	Mí	Midh	Moy	Untá	Miá	Ort.† Ondong Pándong. Kivong	Unddí
Two	Barria	Barria	Barria	Enótan	Baria	Twr. Mákis in-dual	Ranú
Three	Apia	Piá	Apia	Manótan	Apia	Same as Hindi and Urdu.	Múnú
Four	Upúnia	Ponia	Upúnia	Nákhótan	Upniá		Nálú
Five	Moya	Moné gótang*	Monaya	Panjé gotan H	Moria		Saijhan
Six	Túria	Túrúi gótang	Túrúyá	Sé gotan H	Túriá		Sáróng
Seven	Iyá	Iair gótang	Sáth H	Sat gotan H	Sáth H		Yénú, Yétú
Eight	Irlia	Iral gótang	Áth H	Áté gotan H	Áth H		Anamúr
Nine	Aréá	Aré gótang	Nou H	Nó gotan H	Nókó H		Nó H
Ten	Geléá	Gél gótang	Das H	Das gotan H	Dasgo H		Pada
Twenty	Hissi	Caret	Caret	Bís H	Bís H		Bísa H
Thirty	Hissi geléá	Hissi gél gótang	Moy hissi dasti	Derh kori H	Tís H		Tís H
Forty	Bárhissi	Bár hissi	Bár hissi	Bisénd	Bár hissi dasgo		Chálís H
Fifty	Moy hissigil	Bár hissi go*	Bar hissi dasti	Dharihé kóri	Bár hissi dasgo	As in Urdu	Pachás H
A hundred	Moy hissi	Monay hissi	Sou H	Sé H	Midso		Só H
Of	Caret	Caret	Caret	Ye	Kí H	By affix to the noun.	Orá, Bará
To	Té	Té	Caret	Gai	Kó H		Baina
From	Té	Té	Caret	Té	Se H		Caret
By, instr.	Tété	Túlé	Caret	Caret	Átam		Túrsé, Dúrsé
With, cum.	Tóté	Túlí	Caret	Sang H	Gatt. Miuna	Gúni	Sang
Without, sine.	Banóá	Banóá	Caret	Ní	Sámá	Walo	Bigúr
In	Ré	Ré	Caret	Ulá	Bhítar H	By affix to the noun.	Imitté
On	Ré Chitan	Ré	Caret	Ulá	Caret		
Now	Ná	Nitging	Caret	Ukú	Náhá	Ánéké	Inga
Then	En	Ena. Uní	Caret	Písá	Inam	Ání	Ada
When ?	Chúilá	Tis	Caret	E'ká héré	Chiélo. Chimto	I kono	Vang pur
To-day	Ná	Teheng	Tising	Inam	Tihin	Iné	Naiú
To-morrow	Gúphá	Gúphá	Gúphá	Nélá	Gappá	Lélé	Ningnai

* Gótang is surplusage and Hindi.

† Art to human beings. Others to diverse things.

English.	1. *Sinhbhúm Kól.*	2. *Sóntál.*	3. *Bhúmij.*	4. *Uráon.*	5. *Múndala.*	6. *Rájmahali.*	7. *Góndi.*
Yesterday	Hólá	Holánó	Hóla	Chéló	Hólá	Chéwr	Nara khai
Here	Néthá	Noáthi	Néthai	Isan	Nithi	Ino	Ingabará
There	Entai	Hanati	E'ta tháï	Háhá	Unthi	Áno	Caret
Where?	Okotai	Okáti	Oko tháï	E'ksan	U'thi	Ikéno	Vagá
Above	Sirma	Sirma	Sirma	Méyah	Chaitan	Méché	Parró
Below	Súbá	Phér	Athé	Kíyah	Látúr	Pissi	Khálai mandar H
Between	Talaré	Taláré	Talaré	Majín	Talar	Máji H	Bíchte mandar H
Without, outside	Racháré	Racháré	Racháré	Báhari H	Báhari H	Dwári	Bahiro mandar H
Within	Bhitar H	Bhitar H	Bhitar H	Ulá	Bhítar H	Ulé	Núpá mandar
Far	Sanginiya	Sanginiya	Sángiya	Gécha	Sangin	Géchi	Langkak mandar
Near	Nia	Súrgí	Járéyá	Hédi	Najík H	Atgi	Múntosa mandar
Little	Húring	Húringi	Húring	Sani	Húring	Jóká	Jarásó mandar
Much	E'sú	Oriúttar	Burra	Dhér H	Dhér H	Gánrí	Balé mandar
How much?	Chi miáng	Tíná	Chi miáng	Yúng pagi	Chimna	Iná	Banchur
As	Carent	Carent		Carent	Nimnú	Caret	Inchur mandá
So					Sé	Caret	Aróbara
Thus	Ínlíkaté	Húnkaté	Nékagia	Yéli	Nikemeh	Indékí	Íhún
How?	Chi líka	Chika líka	Chi líka	Yékassi	Chilké	Ikna	Báhún
Why?	Chikan minté	Chér minté	Chi líka	Indarí	Chikanlé	Indrik	Bárad
Yes	Hán H	Hóé	Hán H	Háh	Háh	O'nón	Ingé
No	Bano	Banga	Bano	Málá	Bano	Mállá	Hillé
(Do) not	Alam	Alam	Alapé	Ampá	Alú	Caret	Hillé bará
And, also	Undo	Carent		Our H	Inní	Inséki	Udé
Or	Nado			Ís	Áni	Malé	Idaré
This	Néá	Nóá	Ní	Edah	Nia	Íh	Caret
That	E'nó	Hono	Caret	Húdah	Áná	Áh	Caret
Which, jón	Carent Omnino			Ikrah	O'kah	Caret	Caret
Which, tón						Caret	Caret
Which? Kón	Oko	Hana	Caret	Carent		Ik	Caret
What?	Carent		Carent	Indrári	Chikina	Caret	Bará ánd
Who?				Ekóá	O'kówé	Ik	Caret
Any thing	Oko bitté	Oka dhon	Okodhon	Indara	Jáhá, Nági	Indarbadi	Bittíchíj H
Any body	Oko ho	Okúrén horh	Okoji	E'koárten	Oko waihí	Né góté	Vóndi ándi
Eat	Júméman	Júmmén	Júmiábo	Mokháh	Jamémí	Lápá, Móká Mina	Bárátit

English.	1. Sinhbhúm Kól.	2. Sóntal.	3. Bhúmij.	4. Úráon.	5. Múndala.	6. Rájmahali.	7. Góndi.
Drink	Núéman	Nayman	Nayman	Únáh	Noimi	Oná	Yérú undkar
Sleep	Gitíman	Gitikéman	Gitijúm	Khándara	Dúróng	Kándrá	Súngji
Wake	Birman	Biritman	Rúárman	Amha khandara	Adágya	Ejra	Jagémám
Laugh	Landaiman	Landman	Landai	Alíkah	Caret	A'lká	Kavítoní
Weep	Raiman	Ragman	Eyamman	Chinkháh	É'yamtémi	Olgá	Arátó
Be silent	Hápauman	Hapékoman	Hapiakanman	Amhakachnékrah	Happá	Aslúbehá	Immakammeneman
Speak	Kajíman	Rorhman	Kajiman	Kachnékrah	Kajémi	Auda	Bárámanké
Come	Hújúman	Hijúman	Hijúman	Báná	Déla bájúm	Bárá	Báránígá
Go	Sanóman	Chalahman	Sanóman	Kálá	Dúsenámi	Eká, Kálá	Hannogáímá
Stand up	Tíngúnman	Matinggúnman	Tingúákanman	Illáhá	Tengúnmi	Choíyá	Tedánígá
Sit down	Dúbman	Dúrúpman	Dúrúbkanman	Úkha	Dúmí	Oká	Uddánígá
Move, walk	Sanóman	Dilangchalahman	Dholábúsanóman	Gúcha	Sénámí	Sakrá ?	Táká
Run	Níriman	Dúrman	Dúrman	Bóngá	Lírmí	Bóngá	Bittá
Give	Immaiman	Immaiman	Úmaiman	Chhíá	Dá	Katá	Sí
Take	Né	Né	Né	Oánda	Né	Kinda	Tará
Strike	Goiman	Dalmain	Magíman	Khórah	Dálí	Bája	Jím
Kill	Margojokai	Goidapolsmon	Margogojiman	Pítalchia	Márgóji H	Pitá	Jaksívaústi
Bring	Dá	Dan	Daigóáguéman	Ondrá	Ágómen	O'ndrá	Taránígá
Take away	Ídíman	Dúídíman	Idimengo	Hóná	É'dímé	Oiyá	Oumaníga
Lift up, raise	Rúkúbman	Túlrúkúbman	Úthaibaitman	Chódá	Rimémi	Chivá	Téhá
Hear	Jaimman	Jyúmman	Jyúmmanmego	Mijnka	Jyoumémi	Mená	Caret
Understand	Adaiman	Únjúmkidda	Etwanachigúm	Bhújarka	Samújhai H	Bújiá H	Pútté
Tell, relate	Kajíman	Rorhman	Kajiman	Káchana	Kájí	Téngá	Kantáná manjé
Good	Búgí	Búgí	Búgí	Bésri	Bógí	Crú	Bésmanda H
Bad	Etka	Bariéna	Júdajanna	Maidan	Kábésá	Báná	Búró manda H
Cold	Rabang	Rabang	Rabang	Ekh	Réártana	Paniai	Múragta
Hot	Lóló	Loloa	Gúmár	Bidáh	Balhaltan	Kúrni	Kástai
Raw	Baral	Baralgia	Baral	Khéna, Arha	Béral	Kéné	Kachchomanda H
Ripe	Biriéna	Biliéna	Ihsinjanna	Panja	Bilia	Panjéké	Pútá
Sweet	Sibila	Haramgía	Sibila	Tini	Sihil	E'mbé	Mingatá
Sour	Jójó	Jójógía	Jójó	Tissa	Jojou	Tisé	Chúk manda
Bitter	Hárdá	Hawéra	Harrada	Harkhá	Harpand	Karkeh	Kadúta
Handsome	Búgi lika	Uní búgi	Búgikúri	Bésré H	Bés H	Crúgáré	Assal H
Ugly	E'suétka lika	Uni barigía	Utea neloa	Málá	Kaihĕs	Caret	Búrótá manda H

English.	1. Sinhbhúm Kól.	2. Sóntal.	3. Bhúmij.	4. Uráon.	5. Múndala.	6. Rájmahali.	7. Góndi.
Straight	Múlí	Búgisajia	Búgi saj	Ujgó	Sójhia H	Jákró	Tukvá
Crooked	Kochamocha	Ochúr	Hessú bánka	Bengko	Kékúndo	Séró	Tédhó
Black	Héndé	Héndé	Hendé	Mokharo	Hendí	Márgo	Kariyal
White	Púndí	Urí púnda	Hessú púnia	Pándrú	Púndí	Jimpro	Panguró
Red	*Hessú árá	*Urí ará	*Bararanga H	Khénsó	Arrah	Késó	Lál H
Green	Gadésosang	Hariyar H	Gadé sosang	Harria H	Harriár H	Kénkajro	Haro H
Long	Jilling	Uri jilling	Baroajilling	Digha S	Jiling	Digaro	Lamba H
Short	Dúngúya	Húrikatógia	Kándia	Phúdá	Húding	Jokka	Chúndur
Tall man	Bátari salangi	Udi úsúlai	Baraisangaluma	Micha	Jiling	Digaro	Jhangchomanda
Short man	Hessú imitingia	Bángorgaintia	Bara bángarba	Natúá H	Húding	Chápó	Chúndúrmanda
Small	Húring	Húringia	Huringia, Káto	Sanka	Húring	Caret	Pataro H
Great	Márang	Márangia	Hisso márang	Kóhá	Márang	Bévó	Mótó H
Round	Dingúrúgia	Gúlándia	Golandia, Gotagia	Gólgól H	Gótá ?	Golé H	Gola H
Square	Upúnkocha	Púnkóna	Upún kón	Chár kóna H	Gótá	Caret	Nálukhúnt [nur
Flat	Mitaulígia	Uri mirsang	Mórsóm	Chaptí H	Chaptia	Barábar H	Naphúral mandá-
Fat	Kiriéná	Uri móta	Barai móta H	Mota H	Mota H	Gandi tarvé	Caret
Thin	Bátaria	Pátalia H	Barai úsú	Serúá	Usú	Gandi walo	Sirsíhattúr.
Weariness	E'súblagiéna	Langiéna	Laga jouálé	Kháridkar	Thakana H	Caret	Dikmandatúr H
Thirst	Totáng tanna	Totang tanna	Totang tanna	Amún kala	Titang	Amkírvá	Yétaksátúr
Hunger	Réngé	Réngé	Réngé	Kéira	Ringat	Kiré	Karúsátúr.

Dorjiling, Nov. 1848.

B. H. Hodgson.

N. B. The postfix H indicates a Hindi or Urdu etymon and the S a Sanscrit origin.

* Hessú, Udi, Bara, Barai, mean 'very' 'extremely' and are mere expletives I suspect.

*Fragments of the history of Mooltan, the Deraját, and Buhawulpoor, from Persian MSS.** *By Lieut.* R. MACLAGAN.

1. *Account of the arrival at Mooltan of Mulik Sohrab, Dodáee Belóch, with Ismael Khan and Futteh Khan, his sons, and of Hájee Khan and Gházee Khan, from the country of Kéch Mekrán: and the foundation of the Deraját.*

It is related in the history called Huft Goolshun, that in the year 874 H. (A. D. 1469,) Sooltan Hoossein, son of Sooltan Kootub-ood-deen, upon the death of the latter, obtained the government of Mooltan. He held the forts of Shór and Chuneewut, Kot Kurór, and Deen Kót. Sheikh Yoosoof, who had been removed from the government of Mooltan on the appointment of Kootub-ood-deen, came to Sooltan Belól Lodee, governor of Delhi, and earnestly entreated his assistance. The Sooltan sent his eldest son, Bareek Shah, with a well appointed force. As soon as the Delhi troops appeared before Mooltan, Sooltan Hoossein issued to oppose them, and a battle ensued. Bareek Shah was discomfited and returned to Delhi.

It was at this time that Mulik Sohráb, of the tribe Dodáee, along with Ishmael Khan and Futteh Khan, his sons, and others of their tribe, arrived from Kech Mekrán,† and entered the service of Sooltan Hoossein. As the hill robbers were then becoming very troublesome in (the province of) Mooltan, Sultan Hoossein rejoiced in the opportune arrival of Mulik Sohrab, and assigned to him the tenure of the country from the fort of Kurór to Deen Kót. On this becoming known, many Beloches came from Kech Mekrán to the service of the Sooltan. The lands, cultivated and waste, along the banks of the Indus were assigned to the Beloches, and the royal revenue began to increase. The old inhabitants of Dera Gházee Khan and Mooltan relate that after Mulik

* These MSS. were obtained at Buhawulpoor in January, 1846. I have only one of them in the original now with me. The other I translated at the time, and have no means now of revising.

† Sir J. Malcolm mentions (Centr. Ind. II. 175), that mercenaries used to come annually from Mekrán to Central India for service. Are there Beloches there now?

Sohrab's arrival, Hájee Khan with his son Gházee Khan, and many of their kindred and tribe, came from Kech Mekrán to enter the service of the Sooltan.

When the tracts along the Indus were in the hands of Mulik Sohráb and Hájee Khan, Mulik Sohráb founded a Déra named after Ishmael Khan, and Hájee Khan another with the name of Gházee Khan.

During the lax and indolent rule of Muhmood, the grandson of Sooltan Hoossein, Gházee Khan seized the greater part of the dependencies of Mooltan and assumed the government. On the death of Gházee Khan, his son Hájee Khan succeeded to the same extent of authority, and, taking advantage of the weakness of the government of Hindoostan,* took possession of several districts on the Indus, towards the south, and became independent. His successors, each on the death of his father, took the name of his own grandfather,—being thus Ghájee Khan and Hájee Khan alternately.

When Mohummud Hoomáyoon Badshah reigned at Delhi, and the countries of the Punjab, Mooltan and Sindh came into the hands of the Chooghutta princes, Gházee Khan the 5th, having come and presented himself before the above named Badshah, and made presents, obtained the Déra, (Ghâzee Khan) and its dependencies in jageer: the charge of these districts and of all their affairs being committed to him. In like manner throughout the Chóghtáee supremacy, the jageer above named was secured to his family in regular succession.

In the year 1152 H. (A. D. 1739,) Nadir Shah fought and conquered Mohummud Shah, emperor of Hindoostan. Mohummud Shah resigned to Nadir Shah the fort of Attok, and other places to the north and west; also Mooltan, the Derajât, the country of Sindh, and Cabul.† When, consequent on this, the Badshah, with the design of

* Now under Ibrahim Lodee.

† The act of cession is thus given by Hanway in his history of Nadir Shah—after preface :—

"The ministers of the Sultan, who is merciful, and the emperor, who is august, formerly sent ambassadors to us to treat of certain demands with which it was our purpose to comply. The ambassador, Mahommed Khan Turkuman, not long since arrived here from Kandahar to remind us thereof; but our ministers having delayed the embassador and postponed answering the letters of his sublime majesty, it at length produced such a misunderstanding between us, that his victorious army

marching upon Sindh, came from Déra Ismael Khan and arrived at

came into Hindostan. We encountered in the fields of Karnal, where victory arose in the east of his undeclining fortune.

* * * * * * *

"But in regard to the illustrious family of Jurghin,* and the honor he professes for the original tree of Turkan, out of the greatness of his soul, and the overflowings of his humanity, he has been pleased to restore to us the crown and gem of Hindostan.

"In consideration of this act of generosity, which no father has ever shown to a son, nor any brother to a brother, we make over to him all the countries to the west of the river Attok, and that of Scind, and Nala Sunkra, which is a branch of the Scind. That is to say Peishor with its territories; the principality of Cabul and Gasna; Hazariját, the mountainous residences of the Afghans; with the castles of Buckhor, Sunkor,† and Khoudabad; the passes, territories and abodes of the Tchoukis and Ballouchees, with the whole province of Tata: also the castle of Ram; the towns of Chun, Sumawali, and Ketra, with all the castles, towns, ports, villages, and open country, from the first rise of the river Attok, with all the country comprehended within its branches, till it empties itself into the sea at Nala Sunkra.

"These we freely give up to the dominion of the powerful sovereign of Persia, and from henceforward our officers and subjects shall evacuate the same and resign the property and government to the Persian king, to be disposed of at his pleasure. We renounce all our right to command, controul, or collect revenues in any of these dominions. But the castle and town of Lohre Bunder, with all the country to the eastward of the river Attok, and of the waters of the Scind and Nala Sunkra, shall, as before, belong to the empire of Hindostan. Dated at Shahjehanabad, the fourth of Mohorim, 1152."—*Hist. of Nadir Shah, Chap.* 11.

There is no mention of Mooltan, which by the terms of the cession, as here given, is retained by the sovereign of Dehli. The meaning of the "towns, &c. and open country from the first rise of the river Attok, with all the country comprehended within its branches, is shown by the last paragraph to be restricted to the country west of the Indus. (Mill, II. 457), says "part of Mooltan" was included in the ceded territory, but he seems to reckon it among the "provinces west of the Indus." Col. Tod, alluding to this cession, says Mooltan was surrendered, (I. 419). It will be seen from the 4th paper here translated that the Sobahdars of Mooltan were appointed from Delhi until 1767, 28 years after Nadir Shah's invasion. The "Nala Sunkra, which is a branch of the Scind," is generally considered to be the Goonee, which now falls into the Sindree lake, and the country to the west of which used to be called Sancara. May it not be the river now called Nala or Nara, which passes Alór, at one time an important branch, and perhaps the main channel of the Indus? Mr. Hanway has this note:—"This is sometimes called Nale Sengure,

* This word is sometimes wrote Gourgan. † This is sometimes wrote Sekir.

Déra Gházee Khan,* Gházee Khan the 10th, who lived at that time, having paid his respects to the Badshah, obtained the royal favor, and was confirmed in the tenure of the Déra and its dependencies. On the death of this same Gházee Khan without issue, in 1172, H., (A. D. 1758,) none of his kindred and country succeeding to the government, they became dispersed in various directions. The Déra and its dependencies accordingly lapsed to the sovereign of Cabul; and Maharajah Koura Mull† was appointed governor by Ahmed Shah. After this Meeán Gholam Shah obtained the government, which he held for 16 years.

which seems to be the island betweeen the Indus and what De Lisle calls the river Drintade."

* The occasion and route of this march upon Sindh are thus given by the authority before quoted: "After passing the Indus, he directed his march to Peishor, where he halted for some days. * * * * From thence, continuing his route towards Cabul, he detached Abdul Baki Khan, with five thousand horse, to receive homage from Khudayar Khan, governor of Pekier. (This country is to the south of Cabul on the Indus bordering upon Multan: I do not find it laid down by De Lisle. There are several forts, and strong places in it, such as Lokheri, Sekier, and Tekier. The people in this country are partly Mahommedans and partly Pagans). This Khan had refused to pay homage to Nadir, now sovereign of that country; and collected a considerable body of forces to oppose the Persian army. * * * * Abdul Baki Khan soon arrived on the frontiers of this country, but was in no situation to reduce Khudayar Khan by force. * * * * Abdul Baki informed the Shah of the circumstances he was in. Nadir being now near Kandahar sent his treasures and heavy baggage under a numerous convoy into that strong fortress, and then directed his course south-east through the country of Hazariját. * * * * *

"As soon as Nadir arrived in the neighbourhood of Khudaabad, the Indian Chief retired with his riches to Emir Kiout, a strong fort on the opposite side of the river Hest-nud, &c. &c."—*Hist. of Nadir Shah, by Jonas Hanway, p.* 393.

One would think Nadir could scarcely have been near Kandahar at that time, and if he had, his course thence would not probably take him viâ Déra Ismael Khan, as the MS. says.

If Hanway's note, given above in parenthesis, means that Roree was included in the country of which Nadir was "now sovereign" this would give grounds for supposing that the Nara is the boundary before alluded to. But no great importance is to be attached to his geographical notes of those regions. He is apparently quite unconscious that "Pekier" and "Sekier" are what he before gave as "Buckhor" and "Sunkur, sometimes wrote Sekir."

† He had been governor of Mooltan since 1746, and now received charge of Déra Gházee Khan in addition.

In the reign of Tymoor Shah, first Zeman Khan Dooranee governed three years, then Mirza Khan Atukzye, 9 years; Sumundur Khan Badoozye, one year; Saadut Khan, son of Mirza Khan, one year.

In the reign of Zeman Shah, Asaad Khan, brother of Futteh Khan Barukzye, governed for two years;—Sumud Khan Populzye, two years; Sheikh Kumur-ood-deen, one year; Ibrahim Khan Populzye, one year; Sumud Khan, brother of Futteh Khan, three years; Nuwab Abd-ool-jubár Khan, three years; Hubeeb-oollah Khan Suddozye, two years; Mohummud Zeman Khan Barukzye, three years.*

In the reign of the Shahzadah Muhmood, Sumundur Khan, two years.

Again, in the reign of his majesty Shoojá-ool-Moolk Muhummud Zeman Khan Barukzye was governor of the Déra, when in the year 1230 H., (A. D. 1814,) Maharaja Runjeet Singh took it from him, and conferred the tenure of that place, along with Hurund and Dájil, and the rest of its dependencies, on Mohummud Sadik Khan, (father of the present Nuwab of Buhawulpoor,) on an annual rental of 4 lakhs.

A. D. 1831, in 1247, Runjeet Singh took into his own hands the district of Déra Gházee Khan, and the rest of the country on that side of the river held by Nuwab Mohummud Buhawul Khan, and the administration was committed to General Ventura. He remained two years, and after him, Deewan Sauwun Mull was appointed Nazim.

Mohummud Ruheem Khan, and Mohummud Yar Khan, of the family of Gházee Khan, now live at Déra Gházee Khan (1845). Only two wells (land) are granted to them for their subsistence.

The Belochees having no royal house, have not been in the custom of making historical records from which details might be gathered, regarding the ancestors of Gházee Khan.

2.—*Account of the attack of Huree Singh, Chunda Singh, and Gunda Singh, called Bhungee,*† *on the estate of the Buhawulpoor*

* This gives a total of 17 years, but the reign of Zeman Shah was only of 7 years' continuance. Timoor Shah died in 1793, and Zeman Shah was dethroned by Muhmood, his brother, in 1800. Perhaps some of the first of these names should be transferred to the previous reign, and part of the three years of the last named governor may have extended into the reign of Muhmood.

† Thus designated, I was informed, not from their being of the caste so named, but from a progenitor, a noted *bhang eater.*

government; and the capture and occupation by these Sirdars, of Mooltan and its dependencies.

From the 'Jawaheer Abbaseeuh,' containing a history of the Abbasee Khalifs, ancestors of the Buhawulpoor rulers,* and from well-informed aged individuals, we learn that in the year 1180 H., (A. D. 1766,) the above named Sirdars made a descent upon Kussoor, from the Gunghoora valley, and took much spoil, jewels, coin, gold and silver. Encouraged by their success, these chiefs looked to further conquest of country and plunder, and many pergunnahs and estates in the Punjab, fell into their hands. In the same year, having arrived with a large force, on the further side of the river (Sutlej) opposite the fort of Moobarikpoor, in the Buhawulpoor country, which is 7 coss from the bank of the Sutlej, they prepared to invade the Buhawulpoor territory. The Khan, Mohummud Moobarik Khan, (great grandfather of the present Nuwab,) ordered his nephew and heir, Mohummud Buhawul Khan the 2d, to cross and oppose the Sirdars on the other side. An agreement was made that the country beyond Pak Puttun, on that side of the river, should remain in the possession of the Sirdars, and the country on the left bank of the Sutlej, as much as belonged to Mohummud Moobarik Khan, and the other Dáoodpootra chiefs, should continue as before, in their possession.

In the year 1185, (A. D. 1771,) Chunda Singh and Gunda Singh went again against Kussoor, in consequence of the complaints of the brahmans against the violence of the Afghans of that place. They destroyed Gurhee Abdoor Ruheem Khan, and took four lakhs of rupees fine from the zumeendars of Kussoor, Humeed Khan, and Othman Khan, Dowlutzye.

On hearing of the death of the victorious Ahmed Shah,—of the accession of Tymoor Shah, and the weakness of his rule, they hastened to subdue Mooltan; and ordered Mujja Singh, at the head of his forces, to attack and pillage Kháee and Sadoollapoor, and the surrounding places on that side of the river subject to Mooltan, and held by the Bhawulpoor government, and other Dáoodpootra Khans. On this, Mohummud Moobarik Khan directed Mohummud Buháwul Khan, (afterwards his successor) to cross with the Dáoodpootra chiefs and a

* See "Account of the origin of the Dáud Putras, by Munshi Mohan Lál," in the 7th Vol. of Journ. As. Soc. Bengal.

select force, and oppose Mujja Singh on the other side. In this encounter several Dáoodpootra chiefs were killed. On the other side many Singhs were killed and wounded. Mujja Singh himself was shot, and the rest fled. Mohummud Buháwul Khan, after this victory, returned to Buhawulpoor.

In the year 1186 H. (June 1772,) in the month Rubbee I., Mohummud Moobarik Khan died, without offspring, and Mohummud Buháwul Khan succeeded his uncle.

At this time Hájee Shereef Suddozye was appointed Soobahdar of Mooltan by Tymoor Shah. His predecessor, Nuwab Shooja Khan, on being removed, went to Shoojáabad, his own jageer; and having arranged his affairs there, came to Buhawulpoor, to consult Buhawul Khan about getting rid of Hájee Shereef Khan. The Nuwab after this returned to his own jageer.

But Hájee Shereef Khan became careless in his government of Mooltan, and did not remit the stipulated payments to the Badshah's treasury. Having disagreed with Mirza Shereef Beg, who was appointed Tuhseeldar, this Mirza went to the Durbar of Tymoor Shah, and, along with Lala Dhurm Dás, merchant, inhabitant of Mooltan, brought the required amount of revenue and obtained the tenure of Mooltan. Hájee Shereef Khan, being displaced, took up his abode at Buhawulpoor. After some days, a difference arose between the two renters; Dhurm Dás was shot by a servant of Shereef Beg, and the Mirza seized the effects of the murdered man. At length, having come to his senses, in dread of retaliation, and punishment by the Badsha, he secretly sent for Sirdars Chunda Singh and Gunda Singh, promising to deliver up to them the fort of Mooltan. The Sirdars, immediately on the receipt of the letter, perceiving the attainment of their object, marched with a large body of their forces from Umritsir, and came with the utmost expedition to Mooltan.

Mirza Shereef Beg, to save his name, made a show of resistance by matchlock firing, and then fled to Tuloomba, 40 coss north of Mooltan. Not considering himself safe there he came to Khyrpoor, in the Buhawulpoor territory, 24 coss eastward from Buhawulpoor. There he died. The Sirdars became masters of Mooltan and its dependencies, and oppressed and plundered the district of Shoojáabad.

In 1190. (A. D. 1776,) Nuwab Shooja Khan died at Shoojáabad,

and was succeeded by his son Nuwab Mozuffur Khan. At this time the Sirdars came from Mooltan with a design of plundering Shoojáabad: but their purpose being defeated, they returned to Mooltan. Their army however spoiled the Shoojáabad district. In consequence of this, Nuwab Mozuffur Khan, in 1191 H. (A. D. 1777) came to Buhawulpoor, desiring the aid of Mohummud Buhawul Khan. The Khan also received an order from Tymoor Shah to expel the Singhs from Mooltan; accordingly, taking the Dáoodpootra chiefs and a select army, came with Nuwab Mozuffur Khan to Mooltan, and laid siege to the city. After 23 days they gained admittance within the city wall by the wicket of Sheikh Rájee Goordézee on the west, and began to slaughter the Singhs and plunder the residents of the city. At this time the Sirdars were staying at Umritsir. The Kiladar of Mooltan, who had been placed there by the Sirdars, with a force, being unable to offer opposition, retired into the citadel, and sent a swift messenger with an account of the state of things, to the Sirdars. The Dáoodpootra chiefs had taken much spoil, and without leave from the Khan had betaken themselves to their own homes, when Sirdar Gunda Singh, with a large force, came with all expedition from Umritsir, and engaging in battle, Buhawul Khan and Mozuffur Khan retired fighting to Shoojáabad. Thence, Buhawul Khan came to Buhawulpoor, and Mozuffur Khan remained in Shoojáabad, sending daily accounts to Tymoor Shah, of the disturbances, and the tyrannical behaviour of the followers of Nanuk. The Badshah, on hearing of the overbearing conduct of the Singhs, ordered Sirdar Behroo Khan, with a proper force, experienced in war, to proceed and expel the Singhs from Mooltan. In 1192 H. he came to Mooltan and besieged the fort. The fort was nearly being taken, but Tymoor having occasion to be engaged in hostilities at Tooran, (the Toorkomans having extended their conquests to the very gates of Khorasán), Behroo Khan was recalled, and, raising the siege, he returned to Cabul. Tymoor's operations at Tooran having ceased, Sirdar Ali Muddud Khan was sent with a large army to expel the Singhs from Mooltan. Tymoor himself, to afford a support to the Sirdar, came to Peshawur and encamped there. Ali Muddud Khan, coming with great speed to Mooltan laid siege to the fort, and reduced the inhabitants to great extremities. It happened that a party in the Badshah's army entertained a wicked design upon his life, on the discovery of which he recalled Ali Muddud Khan.

In 1193 H. (A. D. 1779,) the Badshah himself came with great celerity, with a conquering army, and having arrived at the Eedgah* a cannon shot north of Mooltan, directed the city to be besieged. In a short time it fell into his hands. At this time, Sirdar Gunda Singh was at Umritsir, engaged in a controversy with his brethren, consequent on the death of Chunda Singh, so that he had not an opportunity of coming to Mooltan, to afford assistance and recover the place. The Kiladar of Mooltan, having no hopes of aid from the Sirdar, and fearing the fury of the Shah's army, surrendered, and quitted the Fort, having, through means of Abdool Kurreem Khan, an Afghan of the tribe Babur, whose family were in the fort, obtained protection from the Shah for himself and his comrades. The Shah, entering the fort, caused his sovereignty to be again proclaimed, and bestowed the Khelut of Soobahdáree on Nawab Mozuffur Khan; with a lakh of rupees for the repair of the fort and city walls, and houses of the people, then marched towards Cabul.

Thus, the time these Sirdars held possession of Mooltan was from 1186 to 1193 H. (A. D. 1772 to 1779.)

3.—*Account of the country on the further side of the river (Sutlej) which continued to be held by the Buhawulpoor government, and other Dáoodpootra chiefs during the supremacy of the rulers of Khorasán in the Soobah of Mooltan. (The people of the Buhawulpoor Sircár and Dáoodpootra Khans yearly sent the regular payments to the Soobah of Mooltan, and constantly expended money in advances to the cultivators, and in the repair of forts and wells for their own benefit).*

From the 'Tuwareekh Abbaseeuh,' and verbal information from old persons well acquainted with the circumstances, its appears that in 1159 H. (A. D. 1746,) Maharaja Koura Mull, who is well known by the erection of the fort in the Mooltan country, which bears his name,†

* This appears to be the place which our two unfortunate political officers occupied on their recent mission to Mooltan. The description, 'a cannon shot north of Mooltan,' agrees remarkably with circumstances related to have occurred on that occasion. It is stated that after Mr. Vans Agnew was wounded, "Khan Singh conveyed him towards the Eedgah outside the town, which had been assigned as their residence. Directly they got into the Eedgah, the guns of the place opened on them, and continued firing the whole day. The range however was too long, and no damage was done, &c. &c."

Delhi Gazette, May 3, 1848.

† Gurh Maharaja, a fort about 28 miles from Mooltan, and 3 from the right bank of the Ravee.

was exalted to the Soobahdaree of Mooltan by Nuwab Moéen ood Dowlah, eldest son of the Nuwab Wuzeer Kumur-ood-deen Khan, one of the ministers of the throne of Delhi;* and having killed in battle outside of Mooltan, the Nuwab Hyál-oollah Khan, entitled Shanuwáz Khan, entered on the government of Mooltan. In that year, (A. D. 1746) Nuwab Buhawul Khan, the 1st (great-great grandfather of the present Nuwab, Buhawul Khan the 3rd), founded the city of Buhawulpoor, and maintained a friendly correspondence with the Maharaja. At this time, Nuwab Ján-nisár Khan, at the instigation of Sheikh Mukhdoom Rajee Goordézee, withdrew his allegiance from the Shah. The Maharaja, having come, by desire of Nuwab Moéen-ood-dowlah from Lahore for the purpose of chastising Ján-nisár Khan, arrived by way of Kutchee, near Tanween, at the place where now stands Khyrpoor, in the Buhawulpoor territory. The Khan of Buhawulpoor, having in compliance with a summons, come to this place, had the satisfaction of meeting the Maharaja Koura Mull. Thence they went together to Tehr, called also Pooshtuk Wejranuh, near Khan Bela, in the district of Déra Gházee Khan. The fort of Khan Bela was taken in one day, and Ján-nisár Khan, coming down to the river, fought for three days. At length, during the night, he fled, leaving his camp standing on the bank of the river. After this victory, the Maharaja having settled the affairs of that neighbourhood, and bestowed goods and land on Buhawul Khan and the Dáoodpootras, turned towards Mooltan. He handed over also to Buhawul Khan, the village of Adum-wahu, on the other side of the water, opposite to, and four coss from Buhawalpoor, on a rental of 4000 rupees.

In 1163 H. (A. D. 1749,) Nuwab Mohummed Buhawul Khan died, and was succeeded by his brother Mohummed Moobarik Khan. He, in 1165 H. (A. D. 1751,) purchased the lands of Sheenee Bukhree and Mudwala, from the zumeendars of Tehr, also Bet (the island) and Donewala, from Mukhdoom Sheikh Rajee Goordezee, and brought them into cultivation. In 1174 H. (A. D. 1760,) he received the district of Loodun, as a friendly gift from Shaik Soobhan, the proprietor of Pak Puttun. In 1181 H. (A. D. 1767,) Nuwab Ali Mohummed Khan Khakwanee received the Soobahdaree of Mooltan from Ahmed Shah,

* And from the first MS. we find he was subsequently appointed Governor of Dera Ghazee Khan by Ahmed Shah.

and Sirboolund Khan (Suddozye) was appointed by the Badsha to Déra Ghâzee Khan. Nuwab Ali Mohummud Khan having taken Déra Ghâzee Khan and the Kinjoor district with the aid of Mohummud Moobarik Khan, gave him lands according to agreement, in the southern part of Kutchee, in the districts of Kinjoor, and Dera Ghâzee Khan. After this, he assigned to the Khan, on a rental of 8000 rupees, the lands on the further side of the Sutlej, of Khanwah, Kuhlwân, Adum· wahu, Sirdarwah, Buhawulwah, Futtehpoor, Emamood-deen-poor, and Sheikh-wahn, and he cultivated these districts. In the same year Nuwab Ali Mohummed Khan having taken the land of the zumeendars of the Mylsee tribe from the zumeendars of Futanee, gave the same to Mohummed Jam Khan Dáoodpootra of Khyrpoor, on a rental of 400 rupees. He built the fort there named Mylseean and cut canals for irrigation.

In 1181, when Ahmed Shah returned from his expedition to Hindostan, Nuwab Ali Mohummed Khan, with his son, paid his respects. The Shah being enraged against Ali Mohummed Khan on account of the disrespect he had been guilty of towards Nuwab Shoojá Khan, caused the Nuwab and his son to be slain, and sent both the bodies into Mooltan, as a warning to others—that no one in future might treat the Suddozyes with incivility. The Soobahdaree of Mooltan was conferred on Nuwab Shoojá Khan. In 1194 Buhawul Khan, the 2d, rented the Pergunnahs of Juttoe and Mudwala and others surrounding, from Mirza Khan, Nazim of Dera Ghâzee Khan, and brought them into cultivation.

In the year 1200 H. (A. D. 1785,) Tymoor Shah came down upon Buhawulpoor. Mohummud Buhawul Khan leaving his country, went into the desert, and the fort of Duráwur fell into the hands of the Shah. To the charge of this fort, and the Nizamut of Dera Ghâzee Khan, Shah Mohummud Khan of Mooltan was appointed, through the interest of Abdool Ghufár Khan. Mouladád, a Goojur, rented from the Badshah the Kinjoor district in the territory of Dera Ghâzee Khan, and the southern districts of Kutchee, which had been in the hands of the Buhawulpoor Government. In the meantime, Mohummud Moobarik Khan, eldest son of Mohummud Buhawul Khan, presented himself before the Badshah, and obtained favor. The Badshah moved towards Cabul. Buhawul Khan came back from the desert to Buhawulpoor. Shah Mohummed Khan and the other Afghans of Mooltan, having, on the capture of Durawur

fort, imprisoned and punished the Dáoodpootras who were inside, the Khan, now collecting a great number of boats at the ferry of Oochh, crossed to Seetpoor and captured the families of Shah Mohummed Khan and other Mooltanee Afghans in charge of Durâwur fort. He then brought them to the outside of the fort of Durâwur, and left them there. On this, Shah Mohummud Khan and the other Afghans, beholding the disgrace of their families, made a truce, quitted the fort, and went with their families towards Dera Ghâzee Khan. Thus the Khan came again into the possession of his country.

In 1222 H. (A. D. 1807,) Nuwab Moozuffur Khan went on a pilgrimage to Mecca, and his eldest son, Mohummud Sirafráz Khan, remained in Mooltan in his father's stead. As a mark of friendship he rented to Buhawul Khan the villages of Adumwahu, Khanpoor, Sheergurh, and Kháee, on that side of the river—and the Khan brought these districts into fine cultivation.

In 1225 H. (A. D. 1810,) Ahmed Khan Mooltanee and Dhoomun Singh, jemadars in the Buhawulpoor army, having rebelled against the Khan (Mohummud Sadik Khan), crossed to the Khan's rented lands on the other side of the river, and committed havoc upon them; Nuwab Sirafráz Khan, notwithstanding his father's injunctions, doing nothing to prevent this proceeding of the jemadars. The Khan's army with the Dáoodpootra chiefs crossed and fought with them. On both sides many were killed, Ahmed Khan among the number, and his comrades fled. The Khan sent 12,000 rupees to the heirs of Ahmed Khan. The Khan, in consequence of Sirafráz Khan's not having hindered the jemadars from raising this disturbance, reckoning also upon the feebleness of the Cabul government since 1213, discontinued making any payments for the districts he held on that side of the water.

In 1230 H. (A. D. 1814) the army of Maharaja Runjeet Singh arrived in the neighbourhood of Déra Ghâzee Khan, and along with the army of Mohummud Sadik Khan (of Buhawulpoor), seized the Déra, and its whole district from the hands of Mohummud Zeman Shah. At the Khan's desire, the Déra and its district were conferred by the Maharaja on him, on an annual rental of 4 lakhs of rupees.

In 1248 H. (A. D. 1831) Déra Ghâzee Khan, and all the lands on that side of the river cultivated by the Buhawulpoor government, whether rented or received in free gift, were taken by Maharaja Runjeet Singh into his own hands.

List of Soobahdars of Mooltan.

A. H. 1135, (A. D. 1722).—Hyát oollah Khan, (Shah-nuwáz Khan,) son of Zukureeah Khan,* was appointed by Wuzeer Kumur-ood-deen Khan. In 1152, accompanied Nadir Shah to Sindh, and received the title of Shah-nuwáz Khan.

In 1159, having thrown off his allegiance to the Wuzeer, Maharaja Koura Mull was appointed. The Nuwab was killed outside of Mooltan.

A. H. 1159, (A. D. 1746).—Koura Mull (Maharaja) (Khutree, Tribe Zóod).—Obtained the appointment through Moéen-ood-dowlah, son of Wuzeer Kumur-ood-deen.

The Maharaja generally lived at Lahore. Was killed in battle with Ahmed Shah Badshah.

A. H. 1160, (A. D. 1767).—Ali Mohummud Khan, Khákwánee—(Nuwab.)—Appointed by Ahmed Shah. He ill-treated Shooja Khan Suddozye, and the Badshah, on his return from Hindoostan, hearing the circumstances, put to death him and his son.

A. H. 1182 (A. D. 1768).—Shooja Khan, Suddozye—(Nuwab.)—Was displaced, having displeased Tymoor Shah.

A. H. 1186, (A. D. 1772).—Hajee Shereef Khan, Suddozye—(Nuwab.)—Removed after six months.

A. H. 1186, (A. D. 1772).—Mirza Shereef Beg Moghul, (Názim,) and Dhurm Dás.—They disagreed and Dhurm Dás was killed. Mirza Shereef secretly invited Chundra Singh and Gunda Singh, and the Sikhs came into power.

A. H. 1187, (A. D. 1773).—Sirdars Chunda Singh and Gunda Singh—(Malik)—were expelled by Timor Shah, who appointed Nuwab Moozuffur Khan to be Soobahdar.

A. H. 1193, (A. D. 1779).—Nuwab Mozuffur Khan—(Nuwab.)—Maharaja Runjeet Singh attacked Mooltan. The Nuwab was killed, and Lala Sookh Dyal appointed.

A. H. 1232, and A. H. 1873 V. (A. D. 1816).—Sookh Dyal—(Soobahdar.)—Deficient in his remittances. Was imprisoned and displaced.

A. H. 1876 V. (A. D. 1819).—Sham Singh, Kashmeeree—(Kardar.)—Imprisoned and deposed after six months. 4

* Zukureeah Khan, governor of Lahore at the time of Nadir Shah's invasion.

A. H. 1876 V. (A. D. 1819).—Budun, Huzáree—(Kardar.)—Failed in his accounts. Confined and removed.

A. H. 1878 V. (A. D. 1821).—Déwán Sawun Mull—(Nazim.)—Ruled well from the day of his appointment. Was shot by a robber in the month Kartik 1901, and was succeeded by his son Deewan Moolráj.

A. H. 1901 V. (A. D. 1844) Dewan Moolráj—(Nazim.)

MISCELLANEOUS.

Extract of a letter from DR. CAMPBELL, *to the Hon'ble the* PRESIDENT, *Asiatic Society.*

I am sure that the members of the Asiatic Society will be greatly interested to learn something of the travels and proceedings in the Eastern Himalaya of our distinguished Honorary Member Dr. J. D. Hooker.

He started from Darjeeling on the 27th of last month, fully equipped and attended, for a trip to the Kanglachema pass of the snowy range: and with the purpose of returning by the western shoulder of Kunchinginga and Jongei to Darjeeling.

Circumstances prevented his commencing his journey through Sikim, the direct route. He was therefore very fortunate in being able to go through the Nipal territory, and is now journeying in a portion of that kingdom which has never before been trodden by any European traveller.

For the first week he was subjected to much annoyance from the quarrels and desertions of his Bhotia coolies, and other numerous mishaps inseparable from new venturers in new lands; but a light-heart and enthusiastic spirit are matches for all the ills that travelling flesh is heir to, and so it has been with him. On the 4th, but after making seven journeys of a distance that might have been got over in 3, but for the above disasters, he was on the top of Nangbi—say 14 miles W. of Darjeeling, at an elevation of 10,000 feet above the sea, and the temperature at daylight down to 21° of Faht. This was a trial for his followers, which the lightly-clothed and chicken-hearted portion of them could not stand against: and after relieving him of some of his stores about a dozen of them left him to his fate without their assistance.

This compelled him to make more exertion for the purpose of getting into the road from Harngachy to Walloongchoong, and on the 9th he was at Sakiagong, on a tributary of the Konke river, and ready to move northwards for the snowy range.

He was therefore at that date in a fair way to attain his object, for he says:—"I got a glorious round of angles yesterday, Phughloot, Nangbi, &c. which will do well to fix my position. This is a lovely country, and I am enjoying myself vastly, have a few new plants, lots of observations, and we go north to-morrow."

I shall not fail to report progress as I get it. This is a most important and interesting expedition, worthy of Dr. Hooker's powers, and of it. It will give materials for maps, climatology, botany, &c. &c. for a portion of the Himalaya altogether unexplored and unknown.

Addendum on the Anatomy of Ailurus, by B. H. Hodgson, *Esq.*

I had scarcely despatched to you my description of the anatomy of Ailurus, deduced from two junior specimens, when my shooters killed a mature specimen in my own immediate vicinity, at an elevation of about 7300 feet. It proved to be a female, mature, but only just so, and was killed in a lofty tree. As this type is the sole representative of a family, and is one of the most anomalous of quadrupeds, I shall make no apology for troubling you with a few additional remarks on its anatomy, not however needlessly reiterating what has been already noted, and is free from doubt.

Ailurus fulvens? A female mature but not at all aged, 20½ inches from snout to vent. Has the deep ochreous red of the superior surface of the body, tipt largely with aureous; whence, and from the presently to be noted anatomical differences, I conjecture it may be fulvens and not ochraceus. Teats 8. No anal glands or pores. Lungs with 3 main divisions, about equal, and each composed of one large and one small lobe, 6 lobes in all. Liver also with a primary triple division; its right lobe largest and almost equally bifid; its left lobe next in size and also bifid, but less equally; its central lobe, smallest of all and trifid. Consequently 7 lobes in all. Gall-bladder empty, collapsed, a long ellipse, 1⅝ inch long by ⅝ inch wide, very freely suspended in the cleft of the central lobe of the liver. Its duct, large and distinct, 2

inches long, enters the intestine about that distance below the accessory stomach. Pancreas 2 inches by 1, parallelogramic, with the angles rounded off, its lower margin closely attached to the intestine, and throwing off a small short duct which discharges the pancreatic juice into the gut about $\frac{1}{2}$ inch above the opening of biliary duct. Spleen 5 inches by less 1, shaped like a manis' tongue. Kidneys $1\frac{1}{4}$ inch by $\frac{3}{4}$, and *not* lobulated internally as in the juniors. Uterus with very long horns, each $2\frac{1}{4}$ inch in length, and small round dark ovaries, each $\frac{3}{4}$ inch in diameter. Bladder $2\frac{1}{4}$ inch, empty and collapsed. Intestines $8\frac{1}{2}$ feet long, wide, gradually lessening in width from above downwards from plus $\frac{7}{8}$ inch to minus $\frac{5}{8}$ inch, excepting the last half foot which is 1 inch wide. This last named portion of the intestines has its coats remarkably thickened and furnished internally with longitudinal bands. Elsewhere the intestinal canal shows no trace of bands or other processes. Stomach empty and collapsed, $8\frac{1}{2}$ inches along its greater, and $2\frac{1}{2}$ along its lesser, arch, exclusive of the accessory stomach, which is 3 inches long and $1\frac{1}{8}$ inch wide. The true stomach is a hemisphere in shape and is membranous, with thin equable coats and no internal bands or folds. The accessory stomach is very thick and firm coated, elastic, between muscle and gland, and has its inner surface marked with strong longitudinal bands. The orifices of the true stomach are quite terminal, and the false stomach commences at the pyloric or lower end of the true one.

Teeth $\frac{6}{6}.\ \frac{1:1}{1:1}.\frac{5:5}{5:5}$, the deciduous premolars of the lower jaw being forthcoming. Crowns of the molars *not* flattened, *nor* showing any crusta petrosa, as was the case in the two very perfect but older specimens from which my original description was taken. The crowns in this sample are covered with enamel and furnished with numerous conic tubercles, sufficiently salient but blunt. Cervical vertebræ 7, dorsal 14, lumbar 6, sacral 3, caudal 18, all very satisfactorily ascertained, and again compared with the skeleton of the juniors which shows beyond a doubt 15 dorsals and 5 lumbars. Ribs 14, whereof 8 are true and 6 false. Sternal bones 7, cylindric. Forward process of the keel of the scapula not cylindric as in the juniors, but flattened and having a subordinate process arising from its base. These may be the acromion and coracoid. At all events there are no other processes answering thereto. Considering the very free action of the arm in Ailurus it is

remarkable that the former process infringes considerably on the field of rotation of the humerus. There is not the least trace of a clavicle or pseudo clavicle. This I have very carefully ascertained. Lastly, it should be noted that the ribs are not much bulged, contrary to what was remarked in the juniors; and that the ossa pubis and the sacral vertibræ are, each of them, osseously united, as usual, the opposite characters of the precedent skeletons thus proving (as anticipated) the effects of nonage merely.

In comparing the above details with those priorly given one cannot but note with surprise the remarkable disparities of the teeth and of the spinal vertebræ. My former description of the teeth was taken from two very fine skulls which showed no signs of decay, though it would now appear that they must have belonged to aged subjects, the crowns of whose molars had been worn down greatly by use. *That very use, however, must have been a grinding or triturant one;* and, singularly as the character of the molars is now altered, the sheer fact of wearing in such mode and degree seems to demonstrate that extreme lateral action of the jaws for which I contended, but with which it is not so easy to reconcile the style of the dentition exhibited in the present subject.* What is the normal state of the teeth? and how can we be justified in regarding that state of them as *ab*normal which is found in lusty and vigorous specimens of the animal? The intestinal canal of the present sample is 5 lengths, as before, not so remarkable, however, for width, but more so for the very singular and almost identical modification it undergoes at either extremity. It would seem as if both these peculiarly structured parts of the intestines should be regarded as quasi stomachs, and their effect in harmonising the alimentary canal with the dentition (whatever its normal character) must be material. The variation in the number of the dorsal and lumbar vertebræ is another remarkable peculiarity of Ailurus, as to which however I will only add that the fact is unquestionable, having been carefully and repeatedly seen to. As already hinted, it may be a mark of species.

* The salient processes of the crowns of the molars are more marked than in Ursus: yet the relative narrowness of the lower jaw continues as noticeable as in prior specimens, so that any efficient action of the teeth must be by movements of the jaw, essentially lateral, notwithstanding the deep cylindric hinging!

Letter from Dr. CAMPBELL, *on the Elevation of Peaks in the Himalaya, &c.*

To the Secretaries Asiatic Society, Calcutta.

GENTLEMEN,—I am enabled, by the kindness of Colonel Waugh, the Surveyor General of India, to furnish the Society with the following results of the operations of the Great Trigonometrical Survey in this part of the Himalaya in 1847.

I have also the pleasure to forward a small and beautifully executed Chart of a portion of the Survey, received from Colonel Waugh some months ago.

It was sent to me after the publication in the Society's Journal of my Itinerary to Phari, to illustrate Colonel Waugh's views regarding the position of the celebrated "Chumalari" and of the "Chola" mountain of that Itinerary. When Colonel Waugh left this place in November last, after having satisfied himself in the course of his previous operations of the position of "Chumalari," by observations from Tonglo and Sinchal, I took some Lepchas and Bhotiahs who had travelled into Thibet by the Phari route, with me to the top of Sinchal, to point out Chumalari to them; as they were positive in stating their belief that it was not visible from any part of this neighbourhood, when I said "there is Chumalari," the whole party exclaimed—"No, it is Chola, and not Chumalari." I took pains to ascertain the reasons of their dissent, and afterwards wrote an epitome of them to Colonel Waugh, who thanked me for doing so, said he would file my note with the other documents, and while adhering to his former opinion said, as far as I recollect—"but you may rely upon it that I shall not finally decide the point until you are satisfied that I am right." Thus the matter rested until Colonel Waugh got a copy of my Itinerary to Phari, from the Journal for April last, when he informed me that the delay with respect to the results of the Darjeeling Trigonometrical operations, although greater than he had anticipated, could not then be considered a matter of regret, as it had put him in possession of evidence to prove the identity of his mountain with the great Chumalari of Thibet. "The evidence alluded to," he said, "is contained in your paper published in the Asiatic Society's Journal for April 1848. This valuable contribution to conjectural Geography, has arrived in good time

to be of service to precise Geography, and I am exceedingly obliged to you for the information it contains." He then very clearly and fully argued the whole question, and concluded by saying that the well-timed publication of the Phari Itinerary had enabled him to substantiate that the Peak seen from Sinchal is Chumalari, at the same time he satisfied himself that the "Chola" of that Itinerary is the "Chumanko" of his Survey. On these two points I am alike satisfied, and am very glad indeed that in communicating the dissent of my hill people from the conclusions of Colonel Waugh, I was the means of so soon shewing the triumphs of accurate science over the obstinacy of local ignorance. This is the history of the Chart now forwarded: and I doubt not that the Society will be glad to possess so correct a delineation of these exquisitively accurate observations, pending Colonel Waugh's own publication of the results of his important operations in this quarter. I have arranged the results of the Survey which most interest me under three heads.

1st.—Elevations at and near Darjeeling.

Darjeeling Hill above the sea, ...	7165
Jilla Pahar—highest point, ...	7452
Rockville, ...	7134
Birch Hill, ...	6880.8
Dr. Campbell's House, ...	6966
Bryn Gwyn (Major Crommelin's), ...	6734.9
Lebong, (Mr. Grant's house), ...	6039.3
Sinchal—highest point, ...	8606.7

2nd.—Elevations in Sikim—Sub-Himalaya.

Tendong—called Ararat, ...	8662.8
Tougloo, ...	10079.4
Singalela, ...	12329.2

3rd.—Elevations of Peaks in the Himalayan Range, seen from Darjeeling.

1 Kunchinginga, West Peak,*	28,176.6

* This is, I believe, the highest spot on the surface of the globe. Distance from Darjeeling 45 miles. Elevation of the stations on the plains in the Chart:—" Bundurjoola, 246 feet. Thakooguuj (summit of tower) 267.3; Doom Dangi (Do.) 312.8. These three stations are in the district of Purneah.

A. CAMPBELL.

2	Ditto, East Peak,	27,825.9
3	Junnoo,	25,311.5
4	Kabroo,	24,004.5
5	Powhunry,	23,175.5
6	D. 2,	22,581.9
7	Pundeem,	22,015
8	D. 3,	19,242.10
9	Black Rock,	17,556.9
10	Nursing,	19,139.2
11	Chola,	17,319.5
12	Gipmoochi,	14,509.2
	Thibetan Mountain.	
	Chumalari,	23,929.2

Your's truly,

A. Campbell, *M. D.*

Darjeeling, Nov. 23rd, 1848.

Extract of a letter from Lieut. R. Strachey, Engineers, (communicated by the Hon'ble Mr. Thomason.)

I just write a few words to let you know that we have come back from Tibet. We returned here yesterday, having got along without any difficulty any where. We left this on the 2nd, as I before wrote to you, and got over all the passes on the 7th into the "table-land." We halted the 8th, and on the 9th got to the Sutlej, some miles below Kyunghing. Thence we returned back towards the southern edge of Rakas Tal, reaching Gyanima, or Nimakhan, on the 12th. On the 14th we got within sight of Rakas Tal, and encamped near its southern shore. On the 15th we went on towards Manasarowar, which we reached on the 16th, encamping about a mile or so below Tu-Gamba, the monastery at the effluent from the Lake; we went up to look at the outlet, which was quite unmistakable. The opening is in an elevated beach, and might perhaps be overlooked when the lake was low. The beach of which I talk is rather curious, being evidently the effect of the waves of the lake, and raised perhaps 6 or 8 feet above the level of the water on one side, and of the low ground outside the beach on the other. These beaches are common to both lakes, and are, I suppose, the result of the

frightful winds that blow there, of which we had most freezing examples. I never felt any thing like the wind (excepting at sea) either for cold or intensity; it was absolutely frightful. On the 17th we returned from Manasarowar; on the 19th, we crossed over into the valley of the Karnali, up which we came, passing Lama Choktan on the 23rd, and arrived at the foot of the passes at Chirchun on the 24th. The next day we came over the passes, three in number, of which Unta Dhura is the lowest. The highest ridge crossed will probably be upwards of 18,500 feet above the sea.

From the accident to my barometer, I can't give even any approximation to heights yet—i. e. until I make comparisons with the barometers left here, which I hope to do in a day or so.

The main results of our visit to Tibet are to see that the plains are very evidently produced by Lakes or Sea. The great mass of them being perfect gravel to a depth of 800 or 1000 feet, to which extent the great ravines cut into them.

The part of the country towards the long lake of Gyanima, seems to have been much more recently under water than the other, and in fact appears to be in many places even now imperfectly drained and subject to flood. The whole of the country from the lake of Gyanima to Rakas Tal, and along almost the whole of the southern edge of the latter, is a great eruption of volcanic rock, and the bar between the lakes is probably also caused by this trap eruption, as it consists of gravel (exactly such as now exists *in* the lakes) to a height of 6 or 800 feet above the present level of the water.

With some difficulty I got an observation of the elevations of Kylas and Gurla, from which I hope to get a decent approximation to their height. The dreadful wind almost stopped me altogether—blew away both ends of the tape used for measuring a base for me to work upon, and prevented any thing like real accuracy.

The valley of the Karnálá, Pruang, &c. is also certainly part of the same great deposit of gravel as the rest of the plain to the westward.

The country generally is more hilly than I had anticipated. The plain more flat, in fact perfectly so, with hills rising abruptly from it. The plain seems to run along the northern foot of the Himalaya, the Sutlej apparently having hills along its southern bank all down its course as far as we saw.

We found none of the recent fossils of large animals, of which I have got indifferent specimens from Bhotias which I had hoped to see. They seem to come from more to the westward. An almost unlimited supply of fossil shells may however be got on the passes into Tibet, and some specimens I have got from 18,000 feet at least, probably higher up.

In the latter part of our trip the thermometer has been as low as 15 or 16° at sunrise—but it became rapidly colder at last, and we before suffered more from the violence of the sun than from cold.

Tibetan Type of Mankind.

To the Secretaries of the Asiatic Society of Bengal.

GENTLEMEN,—The accompanying remarks upon a series of human skulls, collected by me in the valley of Nepál, and forming part of the general osteological* collection made in the sub-Himalayas and deposited in the British Museum, are from the pen of the celebrated author of the Physical History of Mankind. The novelty and the importance of accurate ethnological research in India, together with the eminent qualifications of the commentator on these materials, will, I fancy, readily induce the Society to give a place in its Journal to Dr. Prichard's observations, hereto subjoined. Symbhúnáth and Sankmúl are places of interment or cremation in the valley of Nepál, and there the skulls were procured: Dr. Prichard rightly conceived that the skull No. 8 is a typical Tibetan, and the skull No. 4, a normal Néwár, one; and it is very satisfactory to me to find this gentleman's estimate of the physical character of these races as deduced from the crania so perfectly correspondent with that deduced by myself from the living subjects.

I am, Gentlemen, &c.

B. H. HODGSON.

Darjeeling, November, 1848.

* A recent letter from Mr. Gray, the Curator of the British Museum, acquaints me that this collection, the first of the sort ever deposited there, has proved the nucleus of an osteological collection in the great national Institute of England, which already rivals that of any Museum in the world, save the French one, in the single department of Fishes.

Extract of a letter from DR. PRICHARD,

dated, London, August 11th, 1848.

"I am much interested in your researches, and as you requested, I went on the first favourable opportunity to the British Museum and carefully examined your skulls; I enclose the description of them. The impression I derived for the examination is that the Tibetans have the heads of the Chinese, Tartar or Mongolian type, but that the type is not quite constant among them—some of the Bhotia* skulls have very little characteristic difference from Europeans. I suppose No. 8, may be considered as typical, and the rest as deviating from it. No. 8 is a strongly marked Tartar or Turánian head.

The Néwárs† appear to have this type very much softened down, in every particular approximating to the European type.* I take No. 4 to be typical of the Néwárs. It is the most unlike an European, and the most like the Bhotia No. 8, but in every respect less barbarian and less like a Mongol.

The collection is a very valuable one."

Skull marked No. 8, ticketed as that of a Hillman, probably a Cachár Bhotia, procured at Symbhúnáth.

Description.—Skull large, apparently that of a tall and large man, not particularly heavy. Vertex high.—General aspect like that of a Chinese skull.

Front view.—Face broad and flat, particularly in the plane of the cheek bones. Zygomatic arches large and prominent forwards and outwards. Outer corner not rounded off as in the skulls of Esquimaux, but angular. Nasal bones flat—hence the breadth and flatness of the face.

Mouth rather prominent, the upper jaw being prognathous, and the lower jaw large. Supra-orbital ridges rather strongly marked. The outer part of the upper orbital edge, above outer angle of the eye, thick and prominent.

* Bhotia is equivalent to Tibetan; Bhót being the Hindu, and Tibet the Moslem, name of the country. My skulls belonged mostly to Cisnivean or Kachár Bhotias.

† The Néwárs are the people of Nepal proper, or the great Valley.—B. H. H.

Vertical view.—Head oval (seen above): oval figure rather long, viz. the longitudinal diameter is long in proportion to the transverse. The oval figure narrower in the anterior than in the posterior part. Occiput protuberant (not truncated as Retzius thinks it is in the Tartar races), vertical ridge or crest, strongly marked.

Basis of the Skull.—Basis broad (as the basis of the Esquimaux skull in the plate of 4 basis in my Researches into Physical History, vol. I.)

Zygomatic areas (meaning the nearly oval spaces in the view of basis cranii, which are enclosed externally by the Zygomatic arches) large and open as in the figure of the Esquimaux skull above mentioned, but not so oval in shape, the anterior part being more square and angular. Foramen occipitale small.

No. 10, Cachár Bhotia—Symbhúnáth.—Skull a good deal like No. 8, but not so flat-faced. Maxilla superior, prognathous.—Alveolar process round, not so square as in No. 8. Nasal bones not so flat, but face broad in the plane of the cheek bones.—Margins of the orbits thick and prominent, both above and below the orbital cavity.

Basis.—Zygomatic areas large, open, square and angular *anteriorly.* This is the most characteristic trait, and gives rise to the breadth of the face.

No. 2.—Hillman—Bhotia—Symbhúnáth.—Vertical section of the head (vertical figure) of an oval form. Face not broad or flat. Nasal bones prominent. Orbits square. Forehead high and well formed, having the prominences which Gall calls *organs of comparison* well developed. Whole form of skull approaching the European type, and wanting all Chinese and Mongolian characters, except one, viz., the cheek bones are square and angular, and the zygomatic areas in the basis cranii, large and square anteriorly.

No. 4.—Hillman, probably Néwár, procured at Sankmol.

Head large, nearly of the same size as No. 8, and in general shape resembling it, only with all its peculiarities softened.

Cheek bones rounder, not so square and angular. Zygomatic arches not nearly so large. Zygomatic areas viewed in the basis cranii, not nearly so large and open.

Nasal bones much more prominent. Face not nearly so wide and flat. Upper jaw equally prognathous, but the alveolar process not so

square, straight, or broad, anteriorly—more rounded. Head oval—Occiput prominent. Scarcely any vertical ridge or crest.

N. B. All the characters seem to be much softened and approaching the European type, as compared with the Bhotia heads.

No. 7.—Hillman, probably Néwár, procured at Sankmol.

Face not so broad and flat as the Bhotia No. 8, more rounded and prominent in the profile. Head rounded with longitudinal diameter shorter.

Differences from European type as follows—Cheek bones a little more prominent laterally.

Zygomatic areas, seen in the basis cranii, much larger and more open than in an European, and square anteriorly like those of the Bhotia No. 8.

Upper maxilla somewhat prognathous.

No. 16.—Man of the Néwár tribe and Bandya division. Like No. 4 but more European. Face not flat. Cheek bones not laterally projecting —Alveolar process of the upper jaw prominent—Vertical ridge strongly marked, Zygomatic areas and orbital cavities like European.

Lower jaw small.

No. 15.—Another Néwár Bandya.

Head round, oval, with longitudinal diameter short.

Face rather broad and flat, but not so much so as in the Bhotia No. 8. Nasal bones more elevated.

N. B. The chief characters different from the European type are in the shape and size of the zygomatic arches viewed in the basis cranii. Areas more open and their anterior edge angular and square.

No. 20.—Skull from the plains, near the Ganges. Head nearly European; a bad European head.

(Signed) J. C. PRICHARD.

Notes on the Eastern Desert of Egypt, from Gebel Afrit, by the ancient Porphyry quarries of Gebel Dukhan, near to the old station of Gebel Gir; with a brief account of the ruins at Gebel Dukhan, by HEKEKYAN BEY.—*(Communicated by Capt.* NEWBOLD.)

These rough but interesting notes, on a part of Egypt so seldom visited by travellers as its Eastern Desert, were written by my friend, the Bey, in English; and I have adhered as closely as possible to the original, with but trifling alteration. The notes would have been more valuable had a map been laid down of the route, with a list of bearings and distances, and more detailed observations on the general nature of the country traversed. The porphyry quarries of *Gebel Dukhán,* (Mons Porphyritis) are probably coeval with the celebrated breccia quarries of *Wádi Keneh,* and worked in the time of the first Osirtasen, the supposed Pharoah, who ruled over Egypt in the time of Joseph. The beautifully coloured porphyries, green, purple, and red, and much of the basalt used in ancient Egyptian sculpture, were derived in great measure from *Gebel Dukhán,* and its vicinity; whence they were probably conveyed to Coptos on the Nile, and thence easily distributed to various parts of Egypt. The *Wádi* from *Gebel Dukhán* to *Keneh,* the ancient Koinipolis, a little N. of Coptos, is to this day called the *Sikket el Arabíyeh,* the high-road of the Carts.

It is not very clear why the Arabs should give the name *Dukhán* دخان, which literally signifies smoke, to this mountain. We have no evidence of any volcanic eruptive activity within the historic period. It has probably got the name from its colour, particularly when viewed from a distance under a deep blue sky, or from the smoke of the town and huts of the workmen.

The remains of the inscription copied by the Bey from the frieze of the temple near *Gebel Dukhán,* bear the name of the emperor Adrian, with the surname of Trajan, whose son by adoption he was. The temple is dedicated to Sarapis the great, [with his titles of Pluto and the Sun, ΔΙΙ ΗΛΙΩΙ ΜΕΓΑΛΩΙ ΣΑΡΑΠΙΔΙ] and to the other gods in the same temple. Small temples to Sarapis are very common in the vicinity of mines and quarries. As Pluto he is supposed to preside over demons and the evil genii, who the orientals imagine, watch over the treasures of

the earth. *Gebel Dukhán* lies in about latitude N. 27° 16′ and longitude E. 33°. There is an ancient road leading from it to Myos Hormus, an old port on the Red Sea, from which it is distant about 32 miles as the crow flies.

Hekekyan Bey's Journal.

April 17th, 1844.—Sandstone is the prevalent rock for the first half hour, succeeded by granite, gneiss, black and red basalt, to *Wádi Keneh*.

April 18th.—Granite and porphyry were the prevalent rocks during this, and the two following days' march.

April 21st.—Granite and basalt. The road from *Dukhán* to Keneh is called the *Sikket el Arabíyeh* (the road of the chariots) to this day. There are the foundations of a station at *Wádi Billi.*

April 22nd.—Up Wádi úm Yesúr, granite and basalt.

April 23rd.—Fort of *Gebel Dukhán.* Here is a temple of white-spotted granite with four Ionic columns; the altar still standing in its original place. On the frieze is a Greek inscription of which the following is a copy :—

ΥΠΕΡ ΣΩΤΗΡΙΑΣ ΚΑΙ ΑΙΩΝΙΟΥ ΝΙΚΗΣ ΤΟΥ ΚΥΡΙΟΥ ΗΜΩΝ ΑΥΤΟΚΡΑΤΟΡΟΣ ΚΑΙΣΑΡΟΣ ΤΡΑΙΑΝΟΥ ΣΕΒΑΣΤΟΥ ΚΑΙ ΤΟΥ ΠΑΝΤΟΣ ΑΥΤΟΥ ΟΙΚΟΥ ΔΙΙ ΗΛΙΩΙ ΜΕΓΑΛΩΙ ΣΑΡΑΠΙΔΙ ΚΑΙ ΤΟΙΣ ΣΥΝΝΑΟΙΣ ΘΕΟΙΣ ΤΟΝ ΝΑΟΝ ΙΚΑΙ ΤΑ ΠΕΡΙ ΤΟΝ ΝΑΟΝ ΕΠΑ ΡΟΙΤΟΣ ΚΑΙΣΑΡΟΣ ΕΓΗΡΙΑΝΟΣ ΕΠΙΡΑΝΝΙΩ ΜΑΡΤΙΑΛΙ ΕΠΑΡΧΩ ΑΕΥΙΡΤΟΥ* ΜΑΡΚΟΥ ΟΥΛΠΙΟΥ ΧΡΗΣΙΜΟΥ ΕΠΙΤΡΟΠΕΥΟΝΤΟΣ ΤΩΝ ΜΕΤΑΛΛΩΝ ΕΠΙ Π ΠΡΟΚΟΥΛΗΙΑΝΟΥ.

Above the *Nakábah*, on the left side of the valley, is a *Tellaah*, up which there is a well of sweet water, probably a spring. The *Tellaah* contains green plants. The *Nakábah* below it is composed of some ten tortuously branched spreading trees, giving an agreeable shade. There is a well close by them, and ruins adjoining, whose remains indicate the site of a regularly laid out plan of buildings, and show that water must formerly have abounded here, and that gardens were kept up.

The *Wádi* here expands into an amphitheatre. The clear purple cross of Gebel Dukhán (W. by N. W.) under a dark blue sky, crown the more sombre and gloomy mountains of porphyry, amidst which the *Wádi* serpentines. Tufted shrubs and plants of every shade of

* αιγυπτου ?

green, each with its blossom of varied colours, grow among the masses of purple, green, red, and black porphyries, under shady archways formed by the bending branches, and foliage of the *Nebkh*,* whose fruit was as yet green.

We took water of the *Maitha*, and, debouching out of the valley, struck down into *Wádi Billi*, and ascended it as far as the *Silloa*, when we halted. This part of Wádi Billi is full of Persica and Seyaleh, (Acacia seyaleh), and numerous kinds of plants; the Arabs say that the lower part of the Wádi contains *forests* of *Seyaleh*. The inferior granites here are more friable, and whiter; they have rounded surfaces and summits,† and are free from dykes of felspar. The upper granites on the contrary are more rugged and perpendicular as the height increases.

There are in Wádi Billi signal-posts, mile-stones, guard-houses, forts, wells and stations. Near *Ain Abu Markhah* are quarries, and traces of buildings, *Sakiyas*,‡ gardens, a citadel, magazines, brothels, sacred groves, temples, priest's residence, baths, forum, villages, grottos, pottery, green sarcophagus, troughs, blocks of green, purple porphyry, and of black grey-veined breccia. Many Tarantulas (Abu *Shebbath)*.§

Wádi Guttar runs in the direction of the crags of *Gebel Dukhán*, but after passing the well in the middle of the *Wádi* it sweeps southerly towards *Gebel Altarásh*, runs into *Wádi Keneh*, receiving along its course *Wádi's Altarásh*, *Gerzoo*, *Kohel*, and others.

The well station in the middle of *Wádi Guttar* below the *Mazra*, is 150 feet square; it contains the remains of buildings, with strong walls, and there are the remains of buildings, stables and out-houses outside. A dyke with walls 6 feet thick runs across the *Wádi*, probably to retain the water for cultivation.

April 26th.—Left for Keneh, and reached *Tellaat el Um Gesher*, on the summit of which we found rain-water. Here is a Roman station of unburnt brick, with an area of a fort with towers at the angles (bears S. S. W. by S. from *Gebel Dúkhán*.) A large gateway in the centre opens upon the valley. The enclosure, which is about 300 feet long by 200 feet, contains a saki, and a cistern of cement 20 feet by 15, now both filled with sand. Outside, towards the N. and close

* Nebkh, Rhamnus nabeca. T. N.

† Probably felspathic gneiss. T. N.

‡ A watering place, a canal. T. N.

§ *Lit.* Father of the Spiders. T. N.

to the cistern, are the traces of an extensive village, apparently regularly laid out. This and the body of the place, and its interior buildings, are of blocks of dark green felspar, serpentine, &c. from the neighbouring mountains. Fragments of silicified nummulitic limestone, porphyries, granite, and pottery are scattered about.

April 27th.—In $\frac{3}{4}$th of an hour we emerged from the *Múkhayeneh,* and left the granite behind. We now crossed a vast *Farsh,** even and hard as if Macadamized. We were four hours in crossing it to Gebel *Gír*. The *Farsh* is called *Gaá*† *Tiúr*. The old station of *Gebel Gír* stands on a hill. Here are the remains of a reservoir and a lake 300 feet in diameter and 20 feet deep. They are now filled up almost, and plants grow at the bottom. There are the remains also of several cisterns and three aqueducts all dry. Attached to the station in the valley are the traces of regularly laid out stables and lodgings built of limestone, and two excavations; the smaller of which is near the N. of the outer station: the excavated matter is thrown out in the form of a dyke.

The formation is of argillaceous sandstone, in alternate layers, with carboniferous plastic clays; under which are the ferruginous clays and sandstones.

Immediately over them is the silicious limestone, capped by nummulitic limestone. The argillaceous sandstone contains layers of shales, bivalves, &c.

* Fersh فرش, signifies a wide field or plain, also a bed, spread out. T. N.

† قاع طيور more properly the G of Gáa should be the guttural káf. T. N.

PROCEEDINGS

OF THE

ASIATIC SOCIETY OF BENGAL,

For November, 1848.

The usual monthly meeting of the Society was held on the evening of Wednesday, the 1st Nov. 1848.

The Hon'ble Mr. Justice Colvile, President, in the chair.

The accounts and vouchers for September and October were presented.

The following gentlemen having been duly proposed and seconded at the September meeting, were ballotted for and elected members of the Society :—

Capt. Pakenham, Body Guard.

Capt. Powel, Steamer 'Precursor.'

Capt. Banks, Assistant Sec'y to Govt. of India, Mily. Department.

Lieut. Stubbs, Bengal Artillery.

T. A. Anstruther, Esq. Madras C. S. was named as a candidate for ballot at next meeting, proposed by Walter Elliott, Esq. seconded by J. W. Laidlay, Esq.

The *Rev. J. Richards,* Chaplain, Madras Establishment, proposed by Rev. J. Long, seconded by Rev. Mr. Keane.

Notes were received from the following members, requesting their names to be withdrawn :—

W. Storm, Esq. Calcutta.

W. Thornhill, Esq. Nainee Tâl.

Read letters—

From G. A. Bushby, Esq. Sec'y. to Government of India, forwarding for deposit in the Society's Museum, 30 pieces of ancient sculpture collected by Capt. Kittoe.

From the Hon'ble Mr. Thomason, enclosing extract of a letter from Lieut. R. Strachey, Engineers, announcing his return from the lake Manasarowar.

From the Academy of Natural Sciences, Philadelphia, returning thanks for the Society's gift of 28 volumes of Oriental works, published by the Society.

From Lieut. Col. Goodwyn, Engineers, communicating a paper, with plates, on Taper Chain Suspension Bridges.

From Col. Low, giving cover to copy of inscription, and announcing despatch of a further portion of the Singapore rock inscription.

From Rev. Mr. Mason, sending a notice and drawing of a Tenasserim Pine.

From Captain Hutton, a second article on the nidification of Indian Birds.

From Captain Newbold, forwarding notes by His Highness Hekekyan Bey, Honorary Member of the Asiatic Society, on his visit to the Porphyry quarries of Gebel Dukhan.

From Dr. Hooker, Honorary Member of the Asiatic Society, (communicated by the President,) a narrative of his visit to Parusnath, Rotas and the table-land of Behar.

From H. M. Smith, Esq. communicated by Capt. Sanders, giving an account of the supposed efficacy of the leaves of Aristolochia Indica in the treatment of a case of snake bite.

From the Editor of the "Revue des deux Mondes," Paris, soliciting contributions of papers for that Journal.

Resolved, that the Society subscribe for a copy of the *Revue*.

From the Librarian, proposing a reduction in the scale of prices of the Oriental publications of the Society.

Referred to Oriental Section.

From H. M. Elliot, Esq. presenting for the Library a copy of la Mezeraye's History of France, and for the Museum an Egyptian vase taken from a Mummy case.

Dr. O'Shaughnessy presented a copy of Mr. Laidlay's version of, and Notes on the Pilgrimage of Fa Hian, and proposed the following resolution, which was seconded by Mr. Heatley, and unanimously adopted :—

That Mr. Laidlay's version of the travels of Fa Hian be forwarded to the Oriental Section for their examination and report, and with the suggestion that it appears highly deserving of adoption by the Society.

An apology was read from Mr. Piddington, for his absence on ac-

count of illness, and Mr. Blyth made his usual monthly report on the Zoological Department.

LIBRARY.

The following books have been added to the Library since the last meeting.

Presented.

Histoire de France, par François de Mezeraye. Paris, 1643; 3 volumes folio.—By H. M. Elliot, Esq.

Prosodie des langues de l'Orient Musulman, specialement de l'Arabic, du Persan, du Turc et de l'Hindustani; par M. Garcin de Tassy, Paris, 1848, 8vo.—By the Author.

The Report of the British Association for the advancement of Science, for 1847, London, 1848, 8vo.—By the Association.

The Journal of the Indian Archipelago, for Augt. and Sept. 1848, (two copies.)—By the Bengal Government.

Ditto ditto for Sept. 1848.—By the Editor.

The whole works of the most Rev. James Usher, D. D., Vol. XV.—By the Board and Fellows of Trinity College, Dublin.

The Journal of the Royal Geographical Society of London, Vol. XVIII. part I.—By the Society.

The Calcutta Christian Observer, for Oct. 1848.—By the Editors.

The Oriental Christian Spectator, Vol. IX. No. 9.—By the Editor.

The Oriental Baptist, Nos. 22, 23.—By the Editor.

Meteorological Rigister kept at the Surveyor General's Office, Calcutta, for the months of Augt. and Sept. 1848.—By the Deputy Surveyor General.

Statistics of Sugar produced within the Presidencies of Bengal, Fort St. George, and Bombay. Calcutta, 1848. (Pamphlet).—By the Government of Bengal.

Plans of the Captured Sikh Trophies, Folio.—By the Military Board.

Inscriptions on the Captured Sikh Trophies, 4to.—By the Same.

Proceedings of the Twenty-fifth Anniversary Meeting of the Royal Asiatic Society, (Pamphlet).—By the Society.

Upadeshaka, Nos. 21, 22, 23.—By the Editor.

Tatwabodhiní Patricá, Nos. 62, 63.—By the Tatwabodhini Sobha.

Exchanged.

Journal Asiatique, No. 54.

Journal of the Agricultural and Horticultural Society, Vol. VI. Part III.

Jameson's Journal, No. 89.

The Athenæum, Nos. 1082—5.

Purchased.

Alison's History of Europe, Vols. XVIII. XIX. and XX.

Atlas to the above, 16 Nos.

The Kalpa Sútra, and Nava Tatwa: two works illustrative of the Jain Religion and Philosophy, translated from the Magadhi, by the Rev. J. Stevenson, London, 1848, 8vo.

The Edinburgh Review, No. 177.

The North British Review, No. 18.

The Annals and Magazine of Natural History, Nos. 7, 8.

The London, Edinburgh and Dublin Philosophical Magazine, No. 219.

Journal des Savants; April and July, 1848.

Comptes Rendu Hebdomadaires des Seances de l'Academie des Sciences, Nos. 21 and 25, Vol. XXVI. and Nos. 1 to 4, Vol. XXVII.

The Calcutta Review, No. XIX.

(A correct Report) W. B. O'Shaughnessy, Secry.

JOURNAL

OF THE

ASIATIC SOCIETY.

DECEMBER, 1848.

A few Gleanings in Buddhism, by Lieut.-Col. Low.

The following are some of the memoranda, most of which I made long ago while looking over Bali and Siamese books, in presence of Siamese Buddhist priests. I do not profess an acquaintance with the Palí language, but I had in my service until his death a Siamese, but not a priest, of Bankok, who was, for his country at least, a proficient in it. I had not, unfortunately, leisure to avail myself of what he did know of the language for acquiring a competent acquaintance with it, and any how the want of a Pali grammar and dictionary would have been a serious obstacle.

Some of the Siamese contend that the present Buddha had no right to enter Nirváua or Nirbritti, as *his* period had not arrived, and that he attained to this dignity by practising a deception upon Yakaró Ariyá, his elder *brother,* he himself being the *fifth.* The deception is thus described. These two brothers proposed to justly determine which of them was best prepared for the divine condition of Nirvana, by a trial of superhuman skill or power. Two lotus buds were placed before them. Turning their persons from these, but in opposite directions, they repeated certain sacred formulæ, and on resuming their positions found that Ariyá's bud had blossomed, but that his brother's had not. Buddha, pretending some informality, required another trial; and during this he deceitfully changed the buds, and thus appeared the victor. Ariyá, by his intuitive knowledge was aware of the trick; but being of a humane disposition he said nothing, and permitted Buddha to enter Nirvana.

This must, I should think, have been some heretical doctrine; for it can hardly be believed that a religion so based on morality as Buddhism is, would at the threshold of its original temples, have tolerated such a breach of it. I feel convinced, that the comparatively pure Buddhism, which was carried from Ceylon to Cambodia by Buddha Ghósá, and thence by others to Siam, perhaps through Laos, was greatly adulterated, and assumed more of a polytheistic character than its hitherto rather theomachistic dogmas had permitted; about the time when the bráhmans had fully achieved the superiority in India over the Buddhists, and had spread themselves as religionists to the eastward; and when the heretical Buddhist sects, let loose from all restraint, disseminated their own doctrines far and wide.

Much learning and ingenuity has been expended in the West in the endeavour to trace Western Buddhism to the east, but perhaps the prevalent impression on the mind of the eastern orientalist is that it originated in the west and was there the parent of Indian Buddhism, if not indigenous to India. Hinduism too, under the form and impress in which we now find it, must have been brought to India from western regions, *if* it was really the religion of the *bráhmans* as a tribe of foreigners, and not in the main, as I cannot help considering it to be, a particoloured pantheon, tenanted by deities possessing most incongruous attributes, and jumbled up with monstrous and polluted imaginings, and chimeras dire; and thus laboriously and cunningly erected, by the bráhmans, for the gratification of their lust for power, and of their hatred of the Buddhists, on whom they had for centuries kept fixed their basalisk eyes, and not with that expanded desire, which the Buddhists seem to have entertained for the amelioration of the moral condition of mankind.

In admitting that Buddha had a precursor in the same path as himself, we are by no means called upon at the same time to unreflectingly adopt the predecessors of the latter, although there would be nothing, morally, to prevent our even admitting them suppositively; for we should in this case have only to discard the lengthened periods, astronomical or fanciful, which have been assigned to the three first Buddhas, and to bring them nearer to the *bills of mortality*, to render them manageable.

The Buddha of the present period, dating from his apotheosis in

B. C. 543, seems to have had no connexion personally with the nations of the west. But from his religious system, whose roots seem to penetrate to a greater depth than any one appears yet to have reached, or may perhaps be able to reach, and of the volumes, of which not perhaps more than a mere fractional portion has yet been classically examined, rays of light may hereafter emanate to brighten the path both of history and archaiology.

The fact that scarcely any of the names by which Buddha is known are patronymical, but mere titles, leaves open a wide field for their application, and might give rise to a belief that they, or some of them at the least, might have appertained to previous deified mortals.

Of the names, worldly titles, and parentage of the present Buddha, there is now I believe no doubt, and the principal ones may be found in the Mahawanso.

But if any of the names or appellatives now bestowed upon him as contained in the following list, could be proved to have been borrowed, a clue might possibly be found to their original application.

Sir W. Jones gave us a list of Buddha's names, but I believe they are Hindu ones, and most of them also used by Buddhists. But I apprehend that whatever we may receive from that source, relating to Buddhism, cannot, unless corroborated by Buddhist writings be depended upon. I would even look with suspicion upon Buddhist works composed in *Sanscrit,* for when this language superseded the Páli or Magadhi, a change was gradually advancing, the bráhmans were spreading their nets in secret, heresies were corroding the but lately purified doctrines of Buddhism; and the use of Sanscrit rendered it easy for both heretics and bráhmans to color, distort, eliminate or falsify all the Buddhist books which fell into their hands; and which they hoped at least to be able to dovetail into their own system, when they should find it convenient.

The rest, as it is suspected, or rather known, they destroyed.

The names of Buddha, in general, according to Sir W. Jones, are—

1 Muní. 2 Sastri. 3 Munídra. 4 Vinayaca. 5 Samanta. 6 Bhadra. 7 Dharma Rájá. 8 Sugata.

And his titles—

1 Sacyamuni. 2 Sacyasingha. 3 Sarvarthá-siddha. 4 Sud'hodhani. 5 Gautama. 6 Arcaband'hu, or kinsman of the sun. 7 Máyá or child of Máyá, (delusion) or Máyádevisuta.

Buddha is a word, he adds, commonly used for a *mere* wise man, without supernatural powers.

Buddha, like Samana, seems to have been a name or title bestowed on priests, as well as on the Buddha of the period. Samana Khútama, or the man divested of passions, being the Samanakhodam of Siam.

When Budd'ha, or a Buddha, has nearly attained to perfection, he is termed in Siamese sacred Páli books Paramabódhisat [Bod'hisatwa].

I extract from the Siamese Páli work 'Milinda Rájá, the following titles expressive of nature's divinely favored:

Sotá pattimaggá.
Sakidagá mimaggá.
Anágá mitto.
Arahattá ditto.
Sotá patti Phalá.
Saki dágá mi Phalá.
Anágá mi Phalá.
Arahattá Phalá.

The periods assigned in the Milinda Raja to the five Buddhas are—

For the 1st, from the *consolidation* of the world, 12 antara Kalpas.
Ditto 2d, 10 antara Kalpas.
3d, 4th and 5th, also similar periods.

After Metraiyo a space of 12 antara Kalpas will occur, when Sampatti Mahá Meg will appear. Then a period will ensue of 6264 antara Kalpas, at the end of which the world will be consumed by fire, and a new world will be created or will arise, to be called Sangwatto. In the 'Ratana Kalápa Mettaiyo' is described as having been a Bódhi Satwa, of whom there are three classes,—

1. Ughati tango, supremely wise.
2. Wipachi, of great purity of mind, &c.
3. Néyo, possessed of great perseverance; great mental power militates against purity of soul.

The other names and titles of a Buddha, but whether all are strictly Páli I shall not pretend to say, are:

Sri Saraphet.
Buddhí lakhaná.
Budd'há baltabaróm.
Chinnasí.

Saraphet charangsí
Chimarat.
Budd'há Rattaná.
Salsada chan.
Yanna Sappanyó.
Kassa P'halayan.
Samasam Budd'hó.
Barómmá.
Sri Sakhot.
Bárómmá Buddhí Satwa.
Bárómmaming.
Bárómmanát.
Barommayán.

These are titles of Buddhas who have already been and will again be:

Satthá.	Samantachak'khú.
Dasabaló.	Buripanyo.
Sabbanyó.	Maraji.
Dipaduttamó.	Narasiho.
Munindo.	Narawaro.
Náthó.	Dewa Dewo.
Chákkhúmá.	Loká Gúrú.
Angirasó.	D'hammasámi.
Lókanáthó.	Tathágato.
Anadhiwaró.	Sayambhú.
Mahesi.	Warápanyo.
Wináyakó.	Náyako.

In the Páli (Siamese) Ratana Kalápa it is stated that there are three Bódhi Satwa.

I find in it also a list of seven Buddhas ending with Gotama, which with Metteya, who is yet to come, will be eight in all. They are

1. Wipassi, his son Sawajakhanda, and his wife Súdano.
2. Sikk'hi, his son Attúla, and his wife Sabbakáma.
3. Wessabhú, his son Súppabúddhá and his wife Súchitá, (which is the name of one of Indra's wives).
4. Kakúsando, whose son was Anútáro, and wife Aparojini.
5. Kónágámanó, son Sattawáho, wife Súwattati.
6. Kassapo, son Wjita Sena, wife Sunanda.
7. Gotama, son Rahula, wife Bímbá Bhagawati.

Wipassi and Kakúsando rode on horseback when they went to be ordained as priests.

Sikhi and Kónágamano went on elephants. Wessabhú was conveyed in a chariot. Kassapho in a moving palace (Q palankin) and Gotama rode on a horse.

"An account (observes the compiler of the Ratana Kalápa) is to be found of the ages of all of these Buddhas in the book called Buddhánú Pariwatta, Vol 3d."

In Wipassi's time, it is further observed, a chetí or relic fane was built by Púnabbásúto náma Setthi.

In the time of Kakusando, a temple or dagoba was erected by Abhúta Setthi. (I cannot find the proper name of the place but it was doubtless Abhayapura where king Abhayo reigned).

In Konagamana's time a cheti was built by a rich man at Uggo Setthi. The city was Waddha, and Raja Samiddho reigned; a famine prevailed during this time. [Here the royal garden—the city—the prince Samiddho—and Adam's-peak are described as in the Ceylonese Mahawanso].

In Kassapa's time Súmangúla erected a chetí, which was named Yarama, (the Thúpáráma of Ceylon perhaps was named after it.) This was in the country of Wesálipúré to the westward in Manda-dwip, and the Raja was Jaiwanto or Jaiyanto and Adam's-peak was called Subhakúta. The country was much disturbed during this time.

In Gotama's time, a temple was erected by Anata pindi maha Séti.

The Maha Sammati Wangsa, or a genealogy of Buddha from the same work.

1. Rojo Wararojo.
2. Mahá Panátha who came after many ages had lapsed.
3. Mahá Dewa Rájá.
4. Kala Raja ka Raja.
5. Sanjaya.
6. Mahá Dipati Jayaséna had two sons.

1. Jaiyansena who lived in Lanká.
2. Dípakúmára.

Jayasena married into the family of Sákya Rája of Kapila-Watthú. He slew his father (Q. in-law) and became king of that country.

Dípakúmára became king of Dewa Lanká and he had a son.

Jaiya Dipa and a daughter Kacháyana (or Yena).

Jaiyasena's son was Sihahanú and his daughter was Yasodrá.

Jaiyasena married Kachaiyana, and they had five sons.

Suddhod'hana.

Dod'hana.

Sa'lodhana.

Suk'kodhana.

Amítod'hana.

And two daughters Amíttá and Palítá.

Jaiyadipa married Yasódra who had

Janádhipati, son.

Kakayana, daughter.

Janadipatti married Súnanda Dewi, and they had for issue—

1. Maha Maya } Daughters, and
2. Pajapati }

1. Dantapavi } Sons.
2. Súppabudd'ha }

The latter married Amíta, and they had two sons.

1. Subhada Kabhaiyana.
2. Dewadat'ha.

Sudodhana son of Jaiyasena and Kachaiyena married Maha Maya. Their son Sidhatta Kúmára, who married Bimba *alias* Subhada Kachaiyena. Their son was Rahula.

Bárómmálak'hanát.

Bhakk'hawá.

Somdet Satsaná.

Karunná (Karunya).

Maha Krasát.

The following are from the Milinda Raja Four Budd'ho, or classes of priests and titles.

1. Suta Budd'ho—who are deeply read in Pali learning.

2. Chatú sachcha ditto—applied to learned expounders of the doctrine.

3. Pachék'ha ditto—those whose virtuous deeds have brought them to the threshold of Nirvana.

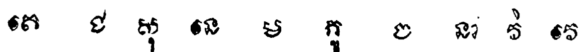
4. Sapp'hanyo ditto—who were divinely gifted or inspired with holy knowledge.

I have a Pali book in my possession bearing the title of Thassachatta ទសជាតក as the Siamese pronounce the words, or the ten sepa-

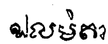
rate states of existence of Buddha. It is in as many volumes, and is rather bulky. With the help of my native assistant I many years ago made short abstracts of each of these sections—and should I find that they may be at all useful in elucidating the history of the kings of central India, and not yet translated, they can be forwarded for the Journal of the Society.

The ten states of the earthly existence of Buddha previous to his becoming a Buddha; from the Pali.

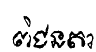
Te	Ja	Su	Né	Ma	Bhú	Cha	Ná	Wi	We
1	2	3	4	5	6	7	8	9	10



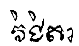
1

 Ela migá.

2

 P'hicha nak'ha.

3

 Wíchita

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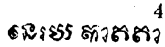 Ne'raya kakh'ata.

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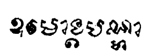 Umaungkha pichta.

6

 Alambhaya hétita.

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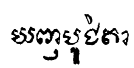
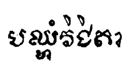
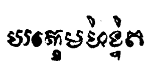
 Yaya púchita.

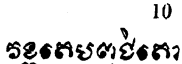
8

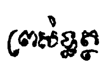
 Panhang wichita.

9

 Yakké mahithita.

10

 Wangkaté pap'hachitto.

 Phra sídhata or thátha.

The Siamese have, but not contrary, I suppose, to the spirit of Buddhism, treated Devadatta (or their Thewathát), the persecutor of Buddha throughout his ten states of existence, with more consideration than he would have, under like circumstances, met with from the bráhmans. He did indeed sink down through the weight of his misdeeds into hell, where he is to remain for one half of an infernal day, each of which is equal to five hundred and six years in the heavenly regions—while one day of such a year is equivalent to one thousand earthly years; but, then again, after having undergone this almost eternal fiery trial, he will return to the earth, become an Arahat, a degree of sanctity to which (only) eight [of Buddha's] disciples attained, and after teaching for seven days will enter Nivana.

Wilford remarked that the Buddhi Satwa of Siam calls Salivahana by the name of Devetat.

My observation does not confirm this, although it is not improbable that the bráhmans introduced the belief amongst some of the Siamese priesthood. In a drawing which I got long ago from a Siamese Bhiku or Bhikchu or Buddhist Priest, this Devadhatta is represented in the lowest or fifth mansion of hell, undergoing his punishment. Wilford, in the Asiatic Researches, describes this victorious personage under the name of *Tacshaca*, observing that he was "crucified by order of Buddha, on an instrument resembling the cross, according to the writings of travellers into Siam. By others he was impaled alive upon a double cross and hurled into the infernal regions, and Samana Gautama foretold that he would be a God in reality."

Hence too, certain writers, wishing, with a very misplaced and mischievous zeal, to have it believed that the Buddhists received their ideas of Devadhatta or Devodassa, from the Christians, although the latter person lived and *sinned* B. C. 543, at the latest, have adduced this cross as a proof of their position. I subjoin a correct copy of the representation in my drawing as above alluded to. From the marks of blood on the arms and legs it should seem that it is intended to represent him as having been nailed to the four beams, and not impaled.

"King Aryyá is the same with the Pra Aryya-sira of the followers of Gautama in Siam and other countries to the eastward of it. He is the mighty pre-chief of the Arryas or Christians, and with him Buddha waged war, as well as with *his* disciple Praswana.

The Aryyá Raja is also the same with the Deva Twash'ta or Deva

tat, who was crucified by rder of Buddha."* "Dévatat being, several times worsted in his wars with Buddha, made overtures of peace, and Samana Gautámá consented on three conditions, first to worship God, then his word, and lastly himself. This last article was rejected, and Tevatat was worsted in the next battle and was taken prisoner, and impaled alive by order of Buddha, and his limbs trussed up upon a *double cross*, and in that state hurled into the infernal regions."† I suspect, with exception of Devatat's enmity to Buddha, the rest of this account is apochryphal; first, there was no prominent self-existent God in the then Indian systems; secondly, it does not appear that Buddha inculcated at any period the worship of himself in his earthly shape, and doubtful if he did so in his future one; and thirdly, such a cruelty inflicted on his enemy was in direct contradiction to the whole tenor of his life, which was marked by practising and preaching humanity, forgiving even the person who poisoned him.

Buddha's disciples were we know numerous enough. They are classed by the Buddhists of Siam as *Araháns*. The chief of these was P'hrá Arahán, but he is stated in the 10th Vol. of the Asiatic Researches "to have been Siva or Uranus, who both preside over astronomy." But the inference or identification does not appear to me to have been proved. His followers are likewise described as having at one period been the most powerful amongst the heterodox sects, meaning the Buddhists in this instance.

The Phra Arahan are borne on the Siamese war flag under the symbol ๘ 8 as there were eight of them—and they are represented in their various stages of the metempsychosis under various forms of half-human half-bestial; or with human heads peeping out of shells, as in Sanchadwip.

In the Páli Book called by the Siamese Milin, which I have supposed to be the Milinda Rájá, and of which I have, as already noticed, a copy, there is a section or passage descriptive of the *Arahantá*, who are rated at 100,000. Amongst these were pre-eminent

Assakhuttá Theró, who full of divine inspiration, abode on the top of the mountain Yukhunthan, (Vicuntha, I suppose,) and who had gone to call Nágásená down (from heaven) when he was a Devatta.

* As. Res. Vol. x. p. 44. † As. Res. Vol. x. pp. 94, 95.

P'hra Nágá, who while a Devatta in Tavatinsa, abode in the palace Kétumti in the west.

Róhana Theró, who was the teacher or spiritual guide of P'hra Nágá until he became priest, and who attended him during the succeeding seven years, until he attained to be *Soda*, or perfectly versed in holy writing, language, and ordinances.

P'hra Nágá was also called P'hra Arahatta when his time of entering the state of Nivan or Nibritti was at hand; and he had become perfect in divine knowledge, and the Dhammanga sacred language. His condition then was that of essassókárám, or of one freed from all earthly affections and passions. His residence was in Pataliputro. This holy man also met with Milinda at the Vihan of the priest the Ayúban Asangk'haiá pariwéná, where were multitudes (80,000) of his followers.

Maurice* curiously classifies the Buddhists thus, on what authority I forget, but I think on Wilford's :—"Mahadeva is believed by the Jainas to have assumed the form of Arahan or Mahiman, accompanied by his wife Mahámauyá" [Buddha's mother Mahá Máyá is perhaps here meant]. "The *heterodox* Indians [by which he here means Buddhists] are divided into three sects. The followers of Jaina, on the borders of India, the Buddhas in Tibet, *who perverted Devodasa*, and the Arahan, said to have been formerly the most powerful, and whose followers now reside principally in Siam." But I have shown that the Siamese do not apply the name to Buddha. The order too I think should have here been reversed. The Buddhists, or so called Arahan first, the Tibetans second, and Jainas the last, for I cannot help being of opinion that the Tibet Buddhists received the doctrine after it had changed its dress from the Pálí to Sanskrit: leaving the most orthodox class in possession of the original books in the Pálí, while the Jainas are confessedly heterodox from both.

Other noted Buddhists were Anirúd'ha, Mahá Kacháyá, Meghi, Khonthan, Assachina, Mahánama, Avapa, Bhakkhaivama, Chúndha, Maha Thero. This last personage is invoked to cure diseases, and is believed by the Siamese to have been a celebrated astronomer.

Ananda, Kacháya Upphakhutta, Anirúd'ha, Malaiya, Kassapha, Ubali, Símp'hali, Dattharatha, Anghulimára, who seems to be the Angulimála who was instructed by Buddha.†

* Indian Antiquities. † As. Res. Vol. II. p. 387.

It is related of this disciple that he was instructed in his duties as a priest, by a high caste brahman, who became much attached to him. He was then however, it seems, of the brahminical sect, for, as the legend runs, this partiality of the spiritual guide towards him so excited the enmity of several other noviciates that they conspired, and accused the favorite to the brahman of carrying on an illicit amour with his daughter.

The brahman, dissembling his rage under the mask of friendship, and with a view to lead to his destruction, sent for the disciple, and communicated to him as a secret a mode by which he would assuredly attain to Nivana without further study. This was to frame a necklace of 109 human sculls (Siva's necklace occasionally). The disciple followed the advice, and had by waylaying travellers and killing them collected 108 of these sculls, when Buddha appeared before him in order to prevent a meditated matricide. The disciple, ignorant of his rank, pursued him to slay him, but Buddha rose into the air, and admonished him, and he, dreading the consequences of his conduct, besought Buddha to pardon him, and place him on the list of his spiritual sons. This legend was doubtless fabricated at a modern period, for if true, which it cannot be, this convert must have been instigated to these reputed and foul murders by a priest either of Kali or of Siva. But it shows how corrupted Buddhism must have become to countenance, as a fact, so attrocious a transgression of the law.

The birth and life of Buddha, as recorded in the Siamese sacred books, agrees closely with the description given in the Mahawanso of Ceylon. The Buddhists attracted so little notice of the learned until some few years back, that I did not think it worth while to publish all of the translations which I had made of portions of Buddha's history. I think it probable that a copy of the Mahawanso may exist in the archives of the palace at Bankok. But no visitor seems yet to have had access to any Siamese *Library* there.

The Siamese have been deeply embued by the brahmans with a mania for astrology, necromancy, and their kindred arts. The following are some of their invocations, which the Sanskrit scholar will readily trace to their source. Empiricism too, being fostered in Siam, these invocations are in high repute with their *faculty*. They are believed

to have been conferred on Buddha by five Devatta Patítha-thá, whose names are given in the Milinda Rájá.

Om.—The all-powerful invocation which was framed by the mighty *Indra* and *Sri Rama* and the divine *Devattas* of all degrees for the use of man in his several occupations and perplexities.

A. U. M., according to the Asiatic Researches* is Vishnu, Siva, and Brahma or Brahmé. It is the *everliving* of the ancient Tartars.†

Faber notices of this celebrated triliteral word that it thus occurs om-phic-al, or the oracle of the Solar God, which the Greeks changed into om-pha-lus, and the Latins into umbilicus.‡ I have alluded further on to this enigmatical triliteral, in connexion with the worship of the sun as the great first Cause and supporter of life throughout the whole of animated nature, according to the ancient Persians.

Invocations.

May the beneficent and powerful throughout the three worlds, heaven, earth, and hell, namely, the glorious Indra or Ph'ant'ha, and Narái or Sri Rama, with all the good and benignant inferior deities give efficacy to their own potent invocation for the attainment of our present desire.

And thou Sri Sarap'hát, who art Buddha or Samana Khatama, and art now in the enjoyment of heavenly rest, who art purified from, and exalted above, every earthly affection, who when *called upon*, art omnipresent, who knowest all hearts, who alone possesses the power and privilege of *walking upon the waves of the ocean*, who nicely discriminateth betwixt good and evil, virtue and vice. And ye inferior Devattas who adore Buddha T'hárani, and thou, O Iswára [P'ho pen chau, of the Siamese, or literally "*man become Lord*] who *established or made the heavens and the earth and all that is in them.*"

Who also framed the equinoctial line [typified by a threefold thread or platted line, and which is used to encircle a new building or a ship to consecrate it].

* Vol. V. p—.
† Key to Hindu Chronology.
‡ Faber's Cabiri, Vol. I. p. 66.

Who art invisible, intangible, and a *respecter of Buddha, although his superior.* "O come with all the benignant powers of that divine Being (Buddha). He who established the Pálí, *founded the sacred* order [the latter one it is to be supposed] of the priesthood, and exhibited in himself a pattern for imitation to the world."

If such were the tenets of early Buddhism, they were much fewer and more theistical than they now are.

"And thou O Maula phi chái, the famous physician of old, whose works have enlightened posterity and Saleng."

"And thou Yama, ruler of the infernal abodes, and *Hunuman* and P'hra Thammayai, and P'hra Thammayan, lend your aid. And ye O Maha Changklí, and P'hra Lai Dárakan, come and render abortive the machinations of evil spirits. And ye all also Krot—Kalinghárát—Phonlawibat—Taling Sakh'an—Narái Seng—Narai Kramáu—Kammayáu—Thammay'i—Sonthayá—Ratri and T'háranisan, the latter of whom wrote a book describing whatever there is of evil in Jumbo Dwipa, in air, earth, or water, and injurious to men, come all and prove propitious.

"And may these invocations which I am going to repeat prove efficacious, seeing that *Iswara* deigned to employ them;—Maha Samai, Maha Chai, Maha D'hammachak, Maha Thassahak, Wi-pasit and Parit.

"And may ye O Buddha ong, and Thitp'ha nangkán and Widok Tháutrai and Sut and Winai be gracious.

"And may I be aided by the Maha Chat or the ten states of existence of Buddha (the fourth) which a priest received from that holy one when he had undergone the tonsure at the lake Anaudat [Manasarowara] previous to or at the period when he entered holy orders, and who had seated himself below a pipul tree.*

"At this spot the divine sage was visited by all the Devattas. It happened that a Yakhsha named Marathera, arrived at the same time. Now this Rakhsha had formerly proffered his daughter in marriage to Buddha along with the *sovereignty of the whole world, at the end of 7 days,* but had been refused, because the offer was coupled with the condition that he should abandon his design of becoming a priest. For Buddha contemned the riches and glories of this world. When Bud-

dha had retired and was reclining beneath his pipul tree (Bo tree), this Rakhsha attacked him out of revenge. But Thárani, the *goddess* of earth, came instantly and *rescued* Buddha [not yet a Buddha] by overwhelming the Rakhsha in a lake of water which she wrung from her ebony tresses."

[This goddess is depicted in this attitude in a Siamese cosmographical drawing in my possession in a compartment betwixt the earth and hell: She occupies the left corner, and Mekhala, I think, the right, and betwixt the two are two snakes entwined and recumbent, but with their heads erect].

"May Methangkaro [a title of Buddha] approaching by the portal of the N. W. render propitious this spell.

Muni Deva, Muni Nagha.
Muni Buddha, Muni Phala.
Sapphé sattru winat sánti."

[Aparagita protects on the N. W.—*As. Res.* vol. viii. p. 83].

"May Sakya Muni K'hatama resplendently enthroned in the N. prove favorable to this spell, [another title of Buddha.]

Sappha Deva.
Pisa Chewa.
Devá Alawakat'hayo.
Picha K'hattha latang t'hittawa.
Sapphé Yakk'há.
Paláyanti."

[Varahi riding on a buffalo protect me on the north.—*As. Res.* vol. viii. p. 83.]

"May Saranangk'haro [another title of Buddha] gracing the N. E. render powerful this spell.

Wipassisará namat'hó.
Chakk'hó matsá (or massa) sirimató.
Sik'hitsa pinawat'husa.
B'húb'húta nukámpinó.
Wetsap'hó (or Wessaphó) sanamat'hó.
Natá Katsak'hapá Sinó."

[Narasinhi protects on the N. E.—*Ibid.*]

"May Kakúsandhó [the 1st Buddha] whose place is every where, prove also propitious to all the spells.

"May T. Yhipp'ha Macárá also shield us by powerful spells, and so may Raja Naga—encircle me with his folds and protect me, and let Saranang come too and Parit aid also."

Then come invocations for the expulsion of national sprites such as the Phi Mon, who are the cause of diseases and possess men, the Phi Chalong or guardian genii of mines and excavations, and to whom I have every reason to believe human sacrifices were made before Buddhism humanised the Hindu-Chinese, or Mahometanism struck down the bloody altars of Siva, next the spirits of women who have died in child-birth. Then philters and charms are to be guarded against, especially those prepared out of materials procured in *cemetries,* and also lightning and other dangers, and against unmarried persons beyond the age of twenty-two years.

Early marriage is so inculcated in Siam that bachelorism after the above age is considered to harbour something devilish about it, and is to be suspected!

Save us likewise from childless people and dreamers.

"May we be aided by Chinnasí and by Sena Barami and Dhamma Barami and by

Budd'hó.
D'hammó.
Sanghó.
Saribut.
Buddhá Banlang.

May Buddha's influence under the following attributes prevail:—

Síla uppa bárami.
Síla báramattha bárami.
Dhammá ditto.
Dhammá uppá ditto.
Ditto baramatha ditto.
Nik'ham barámi.
Panya ditto.
Wiriya ditto.
Khanthí ditto.
Sach'chá ditto.
Athithan ditto.
Metta ditto.
Ubekha ditto.

May Buddha's influence also avert the mischief arising from the spirits of persons who have died a violent death [because such having died in a passion they seek revenge], and from those sprites which hover about the makers of coffins, and door-frames and windows, and flit around all classes of artificers and painters, such people disturbing the spirits pervading matter, the elements, &c. and requiring to make ablutions to drive them away; also the mischiefs produced by the genii of the woods, wells, springs, ditches, and reservoirs, or which follow stage-performers or diggers of hidden treasure."

I may here remark that the Siamese are inveterate seekers for concealed treasure, and that so degenerate have the priests become, that they often set the example. Of this I have had many proofs, and a Siamese who had been a Bhiku or Priest, when he saw me excavating an old ruin, told me as a great secret how to find the treasure he believed I was in search of. Alluding to a book called Tamra Kritsana, lé lai theng, lé len ré pré t'hat—he described such treasure as of three kinds. First, that concealed in the areas of temples [to dig for which is death by the Siamese law, at least where such temples have not been deserted]. The second kind is that which has been buried by charitable persons for the use of those who can find it. The third is that derived from the transmutation of the baser into the precious metals, earths and other substances. This last study, or search for the Philosopher's stone, is in great vogue in Siam.

The simple and innocent owl has not here escaped anathematizing, as being of fearful omen to those over whose house it hoots.

May Patt'ha Muttaró [another title of Buddha] approaching the East or Barap'ha, render efficacious this spell.

"Patt'hamang b'hint'hukang chatang t'hetiyang t'hant'ha méwa chettayang p'hetcha kánchéwa chattut'hang ángkhosá b'hawang pancha sirisang chatang nataró hoti sambhawo." [Sakra guards the East, *As. Res.* vol. vi.] Brahmani protect me on the east riding on a swan, [*As. Res.* vol. viii. p. 83.]

May Buddha or Rewatto propitiously occupying the Akhane or south-east, also assist me with this spell.

[Narayani protects on the S. E.—*Ibid.*)

"Samp'hutdd'hó att'ha wisanchá t'hewat'ha sancha sahatsaké panchá sata sahassani namá mi sirisá ahang tesang dhammanchá sanghanchá

at'hadaré ninamá mi sri sanghán̄g namá márá nub'háwe mahantawá, sapp'hé uppat'hawé aneká antárá yaní piwinat santé asesato."

May Kassiyapa [Buddha] entering the portal of the south, prove propitious with this spell. [Maheswari riding on a bull protects on the south, *Ibid.*]

Trini singhé—the three lions. Sattha nakhé—the seven elephants. Pancha Phichanu name wacha—the five ministers of Indra. Chatu thewá—four Devatas. Cha watsa (wassa) Raja—the six kings. Pancha Indra—the five Indras. Mahit t'hika Eka Yaksha—the Rakhsha. Nawa thewa—the nine Devos. Pancha Brahma or (Phrahma of Siam) —the five Brahmas. Sahabadi T'hawé Raja—the two princes. Attha Arahanta—the eight Arahans. Pansha P'hutt'ho—the five Buddhas.

May Sumangkhaló [another title of Buddha] in the portal of the south-west, assist me with this spell. Chamunda protects in the S. W. [*Ibid.*]

Siromé Buddhá t'hewanchá lalaté Brahmá t'hewda hant'hayé t'hannarai nayakan t'hewá hatt'hat'hepéparang surapat'hó powissonu kanchewá sapp'há kamá pasitt'hémi.

May Buddha Sikkhi, another title of Buddha, seated in the west, aid me in this spell. [Caumari riding on a peacock protect me on the west. *Ibid*].

Faber considers the eight gods of Egypt to be the Octaod, as representing the poetic family, or Archites* spell.

Chatturó.
Nauwá mó.
Thamé chó.
Tri nik'ha.
Pancha.
Sattha.
Attha.
Eka.
Cho.
Sapp'hachai winassanti Buddha.

Buddha received the Buddhist creed from the following deified mortals :—Satakhiriyakk'ho, Asurinthó [or Rahú, I think], Maha Raja of the heaven, Maha Rajika, Sakkotatha or Indra. Maha Brahma, he with four faces.

* Faber's Cabiri.

The creed runs thus—Buddhang pachhakhami, D'hammang pachhakhami, Sanghang pachhakhami. Buddha—the Word—the Hierarchy.

The Vedas were venerated in human shapes because *orally* delivered [A. R.] The brahmans who have in later times gone to Siam continued to instil into many there the belief that [their, the brahman] Trivikrama, and Buddha are the same, alleging that the latter, in guise of an ascetic obtained a boon from a king of Jumbo Dwipa, as much ground as he could compass in three strides, so he compassed the world and thus got the sovereignty, but refused to retain it.

A prominent feature of Buddhism is the veneration of relics.

Some years ago a Siamese priest who had gone to Ceylon to procure relics, arrived at Penang from Siam, bearing the Emperor's order to the priests to erect a relic temple, or Chaittya, there, and deposit part of the relics in it. There are now two principal ones and one inferior Chaittya on the Island.

The inquirer into the origin of Buddhism is in a great measure relieved from the necessity of classifying gods and goddesses, ad infinitum almost. There is only one real type which he has to trace out, through its corruptions.

Buddha it is said, declared that the relics or S'arira were for the vulgar only (meaning the relics of former Buddhas).* But although he certainly did not manifest any particular anxiety as some western heroes did regarding the disposal of his body after his death, the omission must have been owing also in some degree to his being aware that his relics would be worshipped, since the enshrining of those of his predecessors was a rule or dogma of the religion he preached.

The following is from a Siamese version of a Páli work, entitled "An account of the death of Buddha and the distribution of the relics."

"Let all praise and glory be ascribed to the mighty and holy Buddhó, who when he was on the eve of entering the divine state of Nivan was reclining upon a stone couch shaded by the meeting branches of two sacred (Bo) trees near to the country of Kosinaraké, the abode of peace and delight.

"In the year of the little snake Maseng [sappo sang wachcharo] in the sixth month, on Tuesday, at the golden dawn of day, did Phra *Chinnasi* [a title of Buddha] disappear from the earth and rest in Nirvana.

* T. R. A. S. Vol. XII.

" The relics which this divine personage left behind him out of compassion for mankind were in number and quantity as follows :—

First. Seven large bones, namely, two collar bones, the lower jawbone, and four canine teeth. The right collar bone was taken to Ceylon in B. C. 307, and the right canine tooth was preserved for a long time in the capital of the Devos (Mahawanso).

Secondly. Of smaller bones there were sixteen thanan or dona measures.*

All of these remained after the body of Buddha had been consumed by the fire which proceeded from it.

They were afterwards separated into portions. The first portion of the small bones, about the size of split peas, comprised five thanan of the Siamese [dona of the Pali] or measures, and resembled gold of the ninth touch.

The second, about the size of rice grains bruised, and vying in lustre with the adamant, amounted to six measures. The third portion, of the size of mustard seed, amounted to five measures.

These relics were all conveyed away by Garuda, by mankind, and by the Devattas residing in the heavenly mansions.

The first mentioned relics [in whole or in part] were thus disposed of:

First. The *right* bone was secured in a holy Phra Chedi (or Dagoba) in the country Khant'haratt'ha wisái, or in Páli, as the Siamese priest gave it to me, Khantará wisayé (Candahar I suppose).

Secondly. The left *collar* bone was conveyed to Sawanna, and there enshrined. This appears to be the Sawanna pabbato or golden mountain.†

Thirdly. One of the upper canine teeth on the right side was taken to Dáuwadungsa Sawan, or in Páli, Tawatinsa se patit-thi-tang, one of the heavens of the Buddhists, the capital of the Devos by the Mahawanso, and enshrined in a *T'hupani* (or *Sthoupa*).

Fourthly. The lower canine tooth of the right side was carried to Sihala t'hipaké, or Ceylon.

* The limbs of Osiris were burned and parted into fourteen pieces, and were then dispersed all over the world (Wilford and other writers). I am not perfectly certain that this osteology is correctly given.

† Not being quite sure to what part of the body these two bones belonged, and having no clue to their proper names, I have left them unnamed, the rest are named as given to me by my Siamese assistant.

Fifthly. A canine tooth of the left side, was enshrined at *Gand'hara* wisayé.

In the Mahawanso of Ceylon this country is thus noticed, "Gand'hárá and Kasmira" near the "Naga King."*

Sixthly. One of the left lower teeth was deposited in a Fane at *Nag'hapuri.*

The sixteen measures of bones before described were divided into three sorts, and distributed throughout eight different regions of Jambu Dwip, in the proportions of two measures to each. These were probably the pre-eminently Buddhist countries at the period. In B. C. 157, according to the Ceylonese Mahawanso,† there were priests from 14 places in India, who attended the building of the Maha Thupo, namely, *Rajagaha, Isipattana,* a temple near *Báránesi,* Jelo Wiharo (near *Sawathipura)* Mahawanno Wiharo of *Wesali.* The Ghosita temple of *Kosambia, Ujeni* temple, Asóko temple of *Pupphapura, Kasmira, Pallawabhago, Allassada,* the capital of the Yona country (q. Bactria). The *Uttania* temple in *Winjha, Bodhimando,* Wannawaso, and lastly from the *Kelaso Wiharo.* But are we sure that the whole of these fourteen countries were Buddhized during Gotama's life?—In the list of countries visited by Buddha given by me [T. R. A. S. 1831, Vol. III.] the following, which are here named, do not appear, unless names be confounded.

Anlakapaké, Ramakhamo (or gamo), Wet'hatípaké, Weya Képale, Panchala [q. Punjab], Kosali, Mithila, Wideha, Indraprestha, Bráhman's Town [q. trans-Himalayan], Kúrú Khandahara Wisayé, Naghapuri, Pátaliputra. It is true that in the list alluded to Buddha, like Hercules, is said to have visited the four quarters of the world. It should seem that Buddha did not visit Kandahar. This if proved might show that Buddhism had not travelled east or S. E. by that route. But we must I fancy deem it as more probable from its distance from Buddha's birthplace, and from having thus so early after his death obtained relics, that it had been essentially a Buddhist country, in the days of Kassapho Buddha. Indeed it seems to me that all which we possess regarding the Buddhism of India points towards the N. E. from Sakya's birth-place as the quarter whence it emanated.

* Turnour's Translation of the Mahawanso, 171.

† Turnour's Mahawanso, 15, 16, et seq.

1st. To Rajak'hahá (or Rajagriha in Behar); ([illegible] Pálí) also Rajagaha.

The Pálí or Bali from the Milint'ha, [illegible] 2nd. Wesali, [Yampuré.]

This might be Visala or Oujein, but more probably it was Wisali, the capital of the Wajji, the country of the Lichchawi Rajas, mentioned in the Mahawanso.*

3rd. [illegible] Kabiulaphat or Kapilla Watthú (Saming). This appears to have been the birth-place of Buddha, where his father Sud-dhodano reigned. Supposed, observes Turnour, to be in the neigh-bourhood of Hurdwar in India, and to have derived its name from Kapillo, the name of Gótama in a former existence. It is elsewhere noticed as a place called Kapilavastu, N. of Gurruckpore, near upon the Rapti river, where it issues from the hills.† The Siamese say it lies close to the Chinese frontier. In the Mahawanso this country is named Kapilawatthapura.

This is the Burmese Kapila pyé over which reigned Ichada and his line.

4th. [illegible] Anlakapaké may be the Aláwipura of the Mahawanso, (p. 181).

5th. [illegible] Ramak'ham.

This would seem to be Rámágamó of the Mahawanso‡ a town on the Ganges, for in this work, I find it thus noticed :—

"The pre-eminent priest the Thero Mahá Kássapo, being endowed with the foresight of divination in order that he might be prepared for the extensive requisition which would be made (at a future period) by the monarch Dhammasoko for relics (by application) to king Ajata-sattú, caused a great enshrinement of relics to be celebrated with every sacred solemnity in the neighbourhood of Rajagaha; and he transferred the other seven donas of relics (thither), but being cognizant of the wish of the divine teacher (Buddha) *he did not remove the 'dona' deposited at Rájagámo.*" This temple was afterwards destroyed by the inroad of the Ganges, (Mahawanso.)

* Turnour's Mahawanso, p. 73.

† Turnour's Mahawanso, (Index,) p. 11.

‡ *Ibid.* p. 184-5.

6th. [illegible] Wet'hat'hipaké.

7th. [illegible] Pawaiyaka or Wéyaképalé.

This appears to be the Pawananagara of the Mahawanso, (p. 181.)

8th. [illegible] Kosinnarai, Kúsinaraké. The Burmese Kusawady in my list of Burman kings, may have been Kusinagara, or rather the city of Hurdwar, which Mr. Turnour observes is supposed to have been the place where Goutama Buddha died. Buddha however died at Kusinárá, wherever that city lay. In the Mahawanso this country is written Kúsinanagárá,* (p. 181.)

In the Siamese Milin just alluded to, and having several of the features of a Paurana, are some accounts of the relics, which I shall extract.

From the Milin Relics.

[illegible], Relics of Buddha and their size.

[illegible]

Mahabanta pancha nali b'hinna mutta suwanna wanna.

[illegible]

matjima chanali b'hinna khantala p'halika wanna pab'ha.

[illegible]

uthaka pansha nali chasapha matta phikula wanna.

[illegible]

Chaturo d'hat'ha

[illegible]

[illegible]

[illegible]

[illegible]

Then follow the eight countries into which the relics were distributed, as already described, the names agreeing.

Next we have a list of durations and whence derived.

[illegible], or 18 D'hato.

[illegible]	Chako d'hato.
[illegible]	Sota ditto.
[illegible]	Ghana ditto.
[illegible]	Chiwa ditto.
[illegible]	Thaya ditto.
[illegible]	Rupa or roop ditto.
[illegible]	Sat'ha ditto.
[illegible]	K'hant'ha ditto.
[illegible]	Rasa ditto.
[illegible]	Dho tha-pha ditto.
[illegible]	Cha ko wi.
[illegible]	Sota wi.
[illegible]	Ghana wi.
[illegible]	Chiwa-ha.
[illegible]	Kaya wi.
[illegible]	Yana wi.

The dress and effects of Buddha were thus distributed within Jumbo Dwip.

1. His sash or vest to *Pataliputra.*
2. His bathing dress to *Panchala* (Panchal Desa).
3. His drinking cup to *Kosali.*
4. Aranjcha or flint and steel, to *Mithila.*
5. Wéthéhé parisawanang widéhá. His cloth strainer to *Wideha.*
6. Wasi suchi gharanchapi Int'hapat'hé patitt'hita. His sewing apparatus to *Indraprestha.*
7. Upahanang kunchi kanchá t'hawiká yancha sapp'haso usira Brahmana khamé. His slippers and his key (to the temple of Cloacina) to *a brahman's town* (trans-Himalayan?).

8. Pachatharana mang kuté. Lanka Thípé (Dwípé), pattanchapi. His cloth or mat for sitting on, to *Magadha*, and his begging pot to *Lanka*.

9. B'hatd'ha nakarécha chiwarang, Kurunak'haré ni sit 'hanang. His upper dress, or chewon, to the Kuru country.

In the 'Ratana Kalapa' are the following notices :—The body of Buddha was burned on Monday and Tuesday, or the 6th and 7th days of the 6th month, year of the *little snake*. The relics were divided on Thursday on the 8th of the moon's increase, in the 7th month of the year *little snake*. The relics will be all *collected again* upon *Wednesday to Friday* on the 15th of the increase, to 1st and 2d of the decrease in the 6th month in the *rat* year, and they will be finally collected in Nivana (D'hatu Nivana) from Tuesday to Wednesday, the 6th to the 7th of the increase, in the 6th month in the year *rat*. The relics will be first collected and enshrined in a Cheti in Lanká, when all the Devos and Nagas and *Brahmans* will be present, and they will return to Mahá Bodi Mandapa, where Buddha first became a Buddha. Here this holy one will again appear refulgent, and the whole universe will be illumed by his splendour. The deities of the heavens will assemble and utter praises, exclaiming now the time of Buddha has expired, now we shall no longer see him, now has his religion ceased. A fire will then burst forth from Buddha's body and the flames will ascend to the Brahmé lóké. But there will be no more relics.

Ajatasattu Raja protected the faith four months after Buddha entered Nivana, one hundred years after Buddha (B. C. 443) Kalasóka Raja, son of Súsúnaga, became the protector of the faith.

In the year of Buddha 437 (B. C. 106) Wajjagamini (I suppose he may be the Wattagamini of the Mahawanso) appointed Buddhadatta to be chief of the sacerdotal order, at a place called Tissa Maha Wihar, where he had collected 1000 priests.

"It was at this period that they first began to *write* the history and dogmas of Buddha, a labour which occupied (these priests) one year.

A. B. 953. (A. D. 410.)—Mahanamo directed Buddha G'hósá to put the Páli Sihala Att'hakatha and Tika into the Magadha language in order to preserve the same in Jumbo Dwip. (This date and the circumstances closely accord with the account of Buddha Ghósá in the Mahawanso).

A. B. 1587. (A. D. 1044.)—Parrakoum Bahú Raja and the Theró Kassapa convocated 1000 priests and got them to translate into the Magadha language the *Trai Pikok.*

A. B. 855 (A. D. 312) Buddha's tooth was conveyed to Lanká. In the Mahawanso this is reported to have happened in the 9th year of the reign of the Ceylonese sovereign Tirimeghawanno, who ascended the throne in 845, A. B., so that the difference is only ten years betwixt the two accounts.

A. B. 433. (B. C. 110).—The Panchama Sangayanai was compiled or written by order of Wajjagamini or Wattagamini. I do not find this mentioned in the Mahawanso.

A. B. 1000, (A. D. 457.)—In this year Anurudha arrived at Lanká [q. from the Indian continent] and having had all the sacred books copied he shipped them on board of two vessels and returned.

This *Milin* is, I think, the same as an Indian work which I have seen quoted as the Milinda Raja. This one in my possession is headed មិលិន្ទ Milithara, and Milintha Raja, is stated to have been the grandson of Punarathéwa (Deva), who was (king) of Sagala nagara. He built a Degoba on the banks of the Ganges. I believe that it contains chapters on subjects not usually found in Pauranas. But its general purport appears to me to support the statement given in the Asiatic Researches* that the writings of the heretical sects of Hindus [meaning I suppose Buddhists] exhibit quotations from the Vedas, or they might have been quotations from books directly received or brought from Persia. However, as the book is chiefly in the form of dialogues betwixt a king, Milintha Raja, and a priest (of Buddha), it is most likely that they are the same as the Milinda Raja describes. If I can meet with a Siamese priest sufficiently learned in the Palí to be a scholastic guide, I may perhaps be able hereafter to include this in an abstract or catalogue of the Palí works in my possession, and those which I may yet procure, for at present I have neither a grammar (excepting portions of a Palí one untranslated) nor a dictionary to assist me. But the Veda called Caushitaci† contains two dialogues betwixt Indra and Ratardama, and another in which Ajatasattu, king of Kasi (and a Buddhist) communicates divine knowledge to a priest named Balasi.

* A. R. vol. viii. p—. † *Ibid.* vol—. p—.

My copy is evidently an abridged one, for in many places the titles and heads of chapters, and their sub-divisions, only, are given, yet it contains 150 folio pages. The introduction to it informs us that "the Mili (n) thara contains one thousand and one K'hat'ha or chapters."

Raja Milin is further therein stated to have flourished in the period of Kassyapó Buddhó, or the third Buddha, Sakya's immediate predecessor. His preceptor was Nághásèna a [Buddhist] priest. At this time he was son of Athitcha Wangsa, king of Sakhalá or Sagala Nagara. The youth had many angry discussions with his tutor, who was over-rigorous in his discipline. Both died in the usual course of nature, and were born again.

In the year 500 of the Era of Buddho (B. C. 43) Milin was born again, as king of Sak'hálá. Nágaséna was likewise born again, but many years later than Milin, and in time became an officiating priest (of Buddha) and at this latter period Milin had reached a rather advanced stage of life.

This priest is further known under the titles

Wirásená, Ationg papang nakarotiti nak'ho.
Surásená, Senti sayanti été nawat'ha pachat'hikachanati seno.
and Nak'ho chaso senochati nakhaseno.
Siháseuá, Sila khand'ha t'hihi t'hara titi t'hero.

Milin and Nákhasená had a second time left the earth, when a learned priest named Maha Pitaka Chula bháya thera composed this Book, (Milinthara,) purporting to be dialogues betwixt Milin and his said preceptor.

The priest it is added, was considered to have had the best of the argument owing to his former metempsychological abode having been in one of the heavens.

When king Milinthara (last) appeared, the fame of his learning alarmed the priesthood [Buddhist] who could not brook a rival. From this we might infer that Milintha was not a Buddhist. With this feeling one of the Arahanta who resided on the hill Yok'húntara, one of the seven hills of Meru, hurried off to the heaven of Indra, or Tavatinsa, and besought Nakhasénà, who was then a Devata, to visit (or revisit) the earth in order to dash the spiritual arrogance of Raja Milintha. These Arahanta were 80,000 in number, and their chief was named Assak'hutta Thero (before alluded to).

Nakhasena, who was residing then in the resplendent palace Ketumtí Wechayantapasat, in the western quarter (of the heaven), condescended to veil himself in a human shape to save the priesthood from the disgrace of being worsted in argument by a person not of their own *order* (the priesthood). Nakhasena's lineage was as follows:—

1. His paternal grandfather Sóna Brahmaná.
2. Ditto ditto mother Sóni Brahmaní.
3. His maternal grandfather T'hóna Brahmaná.
4. Ditto grandmother Sónant'ha Brahmaní.
5. His father was Sonútta Brahmaná.
6. His mother Sónúttari Brahmaní.

His first residence was called Konlak'hamma, or Donagama, and when he became a priest he resided at the temples and monastery of Esasokarama, in the country of Patalibutta (Pataliputra). His spiritual guide was the learned Rohana Theró, with whom he remained for seven years and ten months; after he had attained to the rank of an officiating B'hikkhú or priest. His piety and knowledge of sacred things then entitled him to be Soda, or one who lives in the world unattracted or corrupted by its frivolous enjoyments or pursuits, and unaffected by its moral vicissitudes. He met Raja Milintha at the abode of the priest Ayuban, who had an immense number of followers of his religion.

Raja Milintha's geneology is thus detailed :—

His paternal grandfather, Punara-t'hewa.

His maternal ditto, Narab'ho K'hawana.

His paternal grandmother, Wichitawi.

His maternal ditto, Sunant'ha.

His father At'hichcha Wangsa (of the race of the sun).

His mother Chant'ha T'hewi (of the divine Lunar race).

His consort was Akk'na Mahesi Int'ha T'hewi.

King Milintha derived much of his knowledge from the sacred books called 1st, Buddha Wuchana, regarding the great saviour, and containing 404 sections or volumes, and from 2d the Winaya pancha chatthicha sattati thawi, satta sutté, abhi dhámmé nawa sathi chattari chattu sattayo (q. the Vinac.)

The abbreviated names of the 28 Buddhas who were anterior to the five Buddhas (including Mettiya who is yet to come) :—

Tang Me Sa Thi Ko Sa So Re So A

Pa Na Pa So So Pi A T'ha Si Ti Pu Wi

Si We Thu P'ho Ka P'ho

Buddhas.

Na Ma Na A Na Ka Na

Ka Ká A Ná Á Ná Á Ká Áng

Females or the Wives of Buddhas.

U Mi A Mi Má P'hi Su Tang

A So Ná P'ho T'hang So Ná A

Some Account of the Battle Field of Alexander and Porus, by Capt. JAMES ABBOTT, *Bengal Artilery—Assistant to the President at Lahore, and Boundary Commissioner, Hazara District.*

WHEN Alexander, encamped upon the western bank of the Hydaspes, justly dreading to land his cavalry in face of a long line of elephants, decided upon crossing at a point higher up the stream, he discovered a suitable spot in a woody promontory of the western bank, opposite to a small woody island in the river. Leaving therefore Craterus with a small column in his standing camp at Jelum to mask the movement, he, in the darkness of a night-storm, aided by the uproar of the elephants, conveyed to the promontory the flower of his army ; and

reaching with them the Island (probably by boat, for it was the season of the monsoon) speedily wafted them across the second channel, and supposed the Hydaspes to be passed. But what was his mortification on discovering that they had but gained a second and larger island, around which, considering the force of the swollen torrent, there could be little hope of timely towing the boats.

At length, however, out of hope, (for such good fortune in such a river, at such a season and after such a storm, was marvellous) they discovered a ford, through which the Phalanx waded breast-deep and gained the eastern bank. It is probable that the dawn broke as they reached the larger island, for the alarm was then given, and Porus hastened from his camp opposite the present Jelum to give him battle. They met upon a level plain of firm sand; the chariots, elephants and infantry of Porus, opposed to the Companion cavalry and to the Macedonian Phalanx. The result was the signal triumph of Alexander and the surrender of his gallant foe.

Now, in glancing the eye over the accompanying chart of the river, we perceive one singular advantage in Alexander's position, viz. that he commanded the chord of an arc in his flank movement; whilst his adversary had to follow the curve. Accordingly, the spot selected by Alexander is about 10 miles from his camp by a level road; whereas it is about 19 miles from the camp of Porus. The river is at this moment so exactly as described by Alexander's historian, that the map might seem rather an ancient than a modern production. The only channel which can be forded during the monsoon is that which I have designated Alexander's channel. The bottom is of massive boulders of quartz firmly imbedded. The soil around is a very firm stratum of mingled sand and clay. In fact, the river Jelum, bursting here from its prison of rock upon the open valley, has inevitably diffused its waters by numerous channels, none of which, owing to the solid substratum of boulders can be deepened beyond a certain level, and whatsoever alterations have occurred in the course of the river since first projected upon the valley, arise from the efforts of the water to find the lowest level of this pavement, from which they were originally deflected by the solid cliff on the western bank opposite the fort of Mungla. The firmness of the soil and the shelter from wind afforded by the height on either side prevent any considerable deposit of sand in the older channels,

which remain naked and sharply defined as when first grooved in the soil, and never entirely lose their office of conduits to the waters.

Nearly all the fifty* islands of the Hydaspes are cultivated. Several are thickly inhabited. But the Tamarisk springs rapidly upon the fallow, forming in three or four years cover sufficient to screen at night the passage of a hostile armament. The length of several of the islands is very considerable. That which I suppose to be the larger island of Alexander† is about 6 miles in length by an average breadth of half a mile. It is cultivated like the mainland: and no one from the level plain of the western side could conjecture it to be an island.

A glance at the map will assure us that from time immemorial there has been but one ferry to the Hydaspes between Mungla and Jelum, and that this ferry must ever have been near its present site at Pindi. Alexander could not have been two days at Jelum without discovering that the river above that point was full of islands,‡ and he would naturally have sought a passage near the ferry, because, at that season none of the numerous channels could be supposed fordable. But as the ferry itself would certainly be (as indeed he found it) watched by a hostile force, he would have made the crossing at sufficient distance to escape their opposition.

Now if we suppose both the old and the new channels to be occupied during the monsoon, as at this day, we shall have opposite the promontory at Bhoonna, a cluster of four small islands,—or if we suppose the minuter channels to be recent, we shall have a single island in their stead. The island immediately abreast could not be reached owing to the power of the current; the boats would therefore thread the small channel (a) and come to at the easternmost island of the group; which if covered, as at this day with Tamarisk, would effectually cover the passage. From thence, on the arrival of the rear-guard, they would put off for what they would naturally suppose to be the mainland, being the land of the established ferry. They would land in the parallel of the village Seem, and would quickly discover that they had reached only a

* Between Mungla and Jelum the number of islands is fifty. Below Jelum there are many more.

† Marked in the map (b).

‡ In one of those islands a contest was maintained between the adventurous spirits of Alexander's and Porus' camps, (see Quintus Curtius.)

very large island. Around this, they could not have towed the boats in time to escape opposition.

The channel intervening between them and the shore is that marked Alexander's channel. It is the only channel of the Jelum fordable during the rains. The map will assure any one familiar with the phenomena of rivers that its depth is lessening every year. And accordingly, it is now only knee-deep during the monsoon. But as the Jelum is more effected by the melted snow of the mountains than by the rain, it is at the moment of writing this* about a foot deeper than during the monsoon.

Now it is a fact with which every military man should acquaint himself, that barring accidental holes, the outermost curvatures in the sinuosities of a river are deepest, the innermost, the point of least depth. And it follows, that between any two windings there exists a ridge or shallow, diagonally connecting the two inner curves. It is therefore probable that the ford was opposite Sirwali.

But be this as it may, there can be no question, that this is the channel across which the Macedonian army waded, breast-deep, on that eventful morning. In the course then of 2175 years, the western channels of the Hydaspes have been enlarged just sufficiently to drain off one half of the water flowing by the easternmost channel. This appears to me an important fact, as offering a standard so much needed by the Antiquary and Geologist for decyphering the handwriting of time.

Allowing, then, that Alexander effected his landing somewhere near Sirwali, the camp of Porus, which must have been opposite Jelum, was distant from the landing-place about 19 miles; a considerable detour being necessary to avoid the quicksands of the Sookaytur. The bed of the Sookaytur, a level plain of sand a mile in width, and dry excepting during the monsoon, interposed at the distance of 9 miles from the camp of Porus, and at the same distance from the landing-place. But this level plain, which might otherwise answer the description of the battle-field, is a torrent after heavy rain, and is so full of quicksands as to be unsuited to military operations. As therefore, Alexander could scarcely have completed his landing before noon, and, as by that time Porus must have been six hours advertized of the movement; allowing for the unreadiness to stir of an Indian army, it is probable that they met in the latitude of the village Pubrál; a plain of firm sand stiffened

* April 1848.

with clay, bounded on the S. west by the Hydaspes, and by a range of low hills and ravines on the N. east, the interval being about 5 miles.

Had Porus but been aware, wherein consisted the peculiar strength of his adversary, wherein the peculiar feebleness of his own array, the narrowness of this battle field might have been turned by him to good account; his right resting upon the quicksands of the Sookaytur opposite Alibeg, and his left upon the Jelum. But it was the encounter of military genius practised in the tactics of eastern foes, with the valor which knew but of one mode of combat.

As I rode upon an elephant over the whole of this haunted ground, splashing across the numberless channels of the crystal Hydaspes, the whole tragedy seemed once more to be enacting around me. The perilous transit of the cavalry, across the swollen and turbid gulf, in the ponderous boats of the country amid the darkness and the thunders of an equinoctial storm. Their formation in the stern silence of perfect discipline. Their sudden mortifying check, as they found a wide, deep and tumultuous current still separating them from the eastern bank; the galloping of horsemen hither and thither to ascertain at once the length of the island and the practicability of fording; their dismay when they found the island almost interminable; their sudden discovery of a ford breast-deep through a current of portentous power, the plunge of the iron clad Companion cavalry and steady stride of the Macedonian Phalaux, hand linked in hand, through the foaming torrent; the splash, the scramble up the farther bank and instant reconstruction of their veteran Battalia; the stern joy of the young conqueror, as he finds that nature ceases to oppose him, and that there remains but the encounter with fellow-men.

Meanwhile, fiery with haste the horsemen of the Powarr are dashing toward the camp of their Raja, and suddenly drawing rein before the guarded enclosure, exclaim breathless, "The men,—the iron-men have crost."

Then the mighty camp is one scene of confusion and of life: warriors snatching up their arms; horsemen saddling their war-steeds or yoking the courser to the chariot of battle; the elephant caparisoned in his iron panoply, surmounted by the castle, filled with bowmen or hurlers of the winged dart; the half drest food relinquished, the half formed lustration abandoned, the half-breathed prayer cut short; whilst

to the sound of the shrilly conch the ranks are rapidly arrayed. And now in one dense, deep mass, the host advances to battle. The cavalry leads the van, throwing out videttes on either hand. The war chariots follow and then the infantry: and lastly, the ponderous elephant, with long, but slow and cautious strides heaves onward his portentous, battlemented bulk; as if the very towers and castles of the sultry east had mustered in life to arrest the invader. Onward rolls the vast tide, heavy with destruction, carefully and warily they cross the treacherous sands of the Sookaytur. The elephant sounds the footing with his trunk and judges of the ground by the echo of that hollow organ. They have past the sands, they are nearing the Hydaspes. Their van is halted. Doubtless the enemy is in sight. No! it is only their corps of observation flying in disorder and dismay: and he who led them shall return no more. The sight inspires the needful caution. The host proceeds more slowly and in better array. The cavalry falls back upon the flanks. The elephants are advanced beyond the infantry, which leaves intervals for their retreat. And now a distant gleam of steel betrays the presence of the invaders, and the Indian host is halted in the plain, the left resting almost on the Hydaspes, the right some furlongs from the hills. Why does not the noble Powarr diminish the intervals to a span. He counts upon them in either case for the manœuvres of his cavalry. He little knows how terrible a cavalry is opposed to his own light horse. Could he but connect with his Phalanx of elephants the hills and the river's brink he might yet be winner of the fight: for the terror of the invader is the companion horse, and they could never face the array of elephants.

Scarcely is the Indian army in position, when the few, but iron squadrons of the invader are at hand. They form, they pause. Their young leader, conspicuous for his lofty crest and costly arms, and the coal black charger which bounds beneath him, reconnoitres the position from flank to flank. Then, like a whirlwind burst upon the devoted wings of the Indian the iron clad Macedonian chivalry: horse and man inspired with the same uncontrollable ardor and with an energy impossible to the exhausted children of the sun. Like the sound of fire amid the forest is the crash, the burst, the turmoil of those strong sons of battle as the ranks go down before them, as the helmet is cleft and the mail is riven and the spear is shivered upon their iron flanks. In

vain does the gallant Raja bear down with all his force to crush or to sweep into the river by the weight and terror of his elephants and the shock of his chariots the destroyers of his broken ranks. For now the Macedonian Phalanx advances and a storm of arrows, of stones and of winged javelins rains upon the timid elephant, or rolls his guider in the dust. Frantic with terror and with pain, the huge monsters reel round upon their master's ranks and spread confusion and dismay. Then rages the tumult of the battle. The light reed arrows of the Indian archer rebound shattered from the plated mail of the Greek. That steady, self-possest, never wavering mass of broad shields and brazen helmets and long protruded pikes, never hurrying ever advancing wins, step by step, its gory way. Death is busy in their ranks but makes no chasm there, for the ready files still close together, self-supported and supporting, whilst over their heads and from either flank the archers and slingers pour their murderous hail.

Meanwhile the battle rages upon the Indian left. Cœnus with his cavalry has past round the right flank of the Indians and driven before him in confusion the succour sent to the other wing. The cavalry that waits to be attacked is lost, and what chance has the timid light-armed horseman of the Indian with men whose souls are fire, their swords sledge hammers, their tunics of tempered steel. The broken and disordered horse are driven pell mell upon the frantic elephants and upon the wavering foot. The chariots whose power is velocity are destroyed without a blow. The whole dense host of the Powarr abandons the field in the panic of flight.

Porus alone maintains the contest. His elephant still wades through the sea of life and death, trampling, destroying, affrighting as he moves. The Tarkhaili chief is sent to summon him. His answer is a winged shaft. Meroo* is more successful. He represents the hopelessness of prolonged resistance, he points to his scattered army, he assures the Raja of honourable terms. Then, the two brave foes meet face to face: the successful robber and the patriot whose heroism is vain. And the robber, whose heart revolts from the iniquity his ambition has devised, soothes the noble spirit whom, without provocation, he has wronged.

Such were the scenes which crowded upon my mind's eye, as for

* Meroo is still a common name in Huzara.

two successive days, from daybreak until evening, I was wading through the crystal waters of the Hydaspes and sketching the topography of the Battle Field. For it happens that the boundary of the Sikh and mountain kingdoms meet upon this most interesting line, and the inhabitants are either side have inherited all the rancour which animated the combatants here in Alexander's day: so that every island is contested, and an accurate plan was essential to enable me to adjudicate the claims.

The scene itself is quite worthy of the stirring memories with which it is associated. The Hydaspes, bursting from the mountains, sweeps around the castle-crowned cliff of Mungla: and exulting in its escape from the prison of the rock, spreads wide its waters over the fertile valley, forming some fifty smiling islands, cultivated and often inhabited. Its waters gushing over a bed of white Quartz Boulders, form by turns, rapid, pool and shallow, each of which has its own peculiar and lovely tint. The shallows ripple in the most liquid of azure, the rapids pass into a delicate crysolite, as they hurry together, entangling the eye and the heart in their ceaseless whirl: the pools engulph those glad dancing waters without addition to their stilly depths, without alleviation to their sombre blue by accession of those sparklers of the deep.

As we gaze up the glittering, living pavement of crysolite and sapphire, fringed on either hand by the lively green of the willow, other hues are brought into direct contrast with our foreground. The distant greens of the graceful Beere and Seesoo, clumped over the Field of Battle, the purple of the successive ranges of mountains of Juppall, and the mighty barrier snow-clad from base to summit, which walls in the loveliest and most unblest of valleys, itself relieved upon the bosom of the azure sky. To Alexander, first arrived from the wretched, ravine-worn waste of Potowar, the scene must have offered happy promise of the land he so coveted to possess. I describe it, as it appears in the winter. At other seasons, but one channel can be forded by the elephant.

To this description I may add, that the Taxiles of the Historian is without doubt the Tarkháili clan,* still inheriting a portion of their

* The personal name of Taxiles was Oomphis. Taxiles was the family name. Khaun i Zemaun Khaun is the present head of the house, to which I lately was permitted to restore their ancestral possessions.

old possessions, viz. the mountain ridge of Gundgurh,* on the left bank of the Indus and about 30 miles above Atok. The Affacini have no doubt long since been identified with the Eusafzyes, who still inhabit the country they then possessed. The long sought rock Aornos towers high above all the neighbouring mountains, its foot washed by the broad flood of the Indus; the wide plains of the Affacini spread below it on the south, their inaccessible valleys on the east and west, its sides covered with dense forests of mountain pine. Its numberless and perennial fountains, the support of the tillage of the mountain skirts; its inexhaustible pastures, the sustenance of myriads of cattle of the Affacini; its forests and fastnesses, the refuge of all the outlaws for hundreds of miles around; its summit, furrowed by a hundred ploughs; its skirts by perhaps eight hundred more; a mountain almost without parallel in the world, and too faithfully described to be mistaken.

There was formerly a fort upon the crest of this mountain, but its very name is lost, although traces of the walls remain, agreeing exactly, if my informant correctly describes them, with the site of Aornos. Professor Wilson has shown that Aornos may be merely the Greek rendering of the Sanscrit word Awur, a fortification. The use of this word is retained only in ancient sites, and the greater number of these have lost it, in the neighbourhood of the Affacini; Kote being substituted, and every old castle whose name is lost being called Kawfur Kote, or the castle of the heathens. Upon the crest of Moha Bunn (a name embracing a whole district comprised by the trunk and ramifications of this mountain, and harboring some ten thousand matchlockmen) Nadir Shah, the Alexander of Persia, encamped his army, as the only means of reducing to order the lawless Affacini. The mountain is a long isolated ridge not less I think in length at summit than 5 miles. The height is upwards of 7000 feet above the sea's level, or 5000 above that of the Indus. The length at base must be upwards of 12 miles. At the very summit is a small square Tumulus apparently from 50 to 100 feet high and scarped with precipices. This may have been the site of the celebrated fortress—Bunn signifies in the language of the country both a forest and a pool, and Maha Bunn

* This mountain, no thanks to the successor of Taxiles, has been my refuge since the mutiny of the Sikh army, and I despatch this packet therefrom. The Mushwanis of Srikote are the truest and bravest race in the Punjab.

means probably the mighty forest, a name well deserved, as standing in the naked plains of the Eusafzyes.

I would not give in to the notion that any thing is exaggerated* by the Greek historians. Such an idea would, I think, lead us astray. Their history, like their sculpture, emanates from a mental organization most critically balanced. The same severity of taste which caused them to discard whatever was superfluous in architecture, whatever was beyond the perfect law of proportion in nature, seems to have dictated a close adherence to truth in their histories, as the secret of historical symmetry. So far as my own observation extends, (and I have wandered over a large portion of Alexander's track) the difficulties are actually underrated: the descriptions so truthful that on visiting the scene, the dramatis personæ seem to confront us, and that wonderful series of conquests seems but the work of yesterday.

The Maha Bunn agrees to the minutest particular with the description of Aornos, standing on the right bank of the Indus, feathered with forests, watered by perennial springs. Its summit, a plateau capable of holding the camp of a Persian army, and of employing a hundred ploughs; its pastures, the support of innumerable cattle; its forests and fastnesses the refuge of the Affacini of the plains and of fugitives from Ahisara and Taxila; its height, gigantic and pre-eminent: its position sufficiently near to annoy Alexander's columns; its inhabitants to this day unconquered, paying neither allegiance nor tribute to any man. Khubul, a large village washed by the waters of the Indus, is still a noted hotel for fugitives from Peshawur and Huzara; so that I was obliged some months ago to blockade it.

The Taxila of history is supposed by Captain Cunningham to be the present Tukht purri or Trukh purri, 6 miles westward of Manukyala. This old site is adjacent to Rabaht, the cemetery of the eastern or Dhangulli branch of the Gukka family, and subsequently the seat of a subdivision of that tribe. The name long ago struck me: but there are some difficulties attending the identification. Taxila was the place selected by Alexander for recruiting the strength of his army. It was also the capital of Taxiles. Now the Tarkhaili have no tradition of

* The breadth of the Hydaspes at Bukephalia appears to me very correctly estimated by Quintus Curtius as four stadia or half a mile, he is speaking of its state during the monsoon.

ever having held lands so far eastward. Tukht purri also is in a bare uninviting country, far from the Indus, where all Alexander's preparations were progressing, viz.: the structure of boats to be carried to the Jelum. Hussun Ubdul appears to me a more probable locality. Its ancient name I have vainly endeavoured to discover. But it must have been an important place very early, on account of the abundance of its water, and of its lying upon the main road between India and Afghanistan. It is also an hereditary appanage of the Tarkhaili wrested from them by the Sikhs within a few years; is the boast of the country for its water, its groves and its salubrious atmosphere: is close to the rich plains of Chuch and the fertile valley of Huzara, and sufficiently near the Indus for communication with the Board of works established there. Tukht or Trukh purri is said to signify the disjected rock; a probable interpretation; the last spine of the sandstone formation jutting up there through the plain in a remarkable manner, accompanied by several enormous disjected masses of Tufa.

On the Maha Bunn the Ivy must, I think, grow in abundance, as I have found it at much lower elevations in Huzara, and Mt. Mœrus must be looked for amongst the subordinate hills of Maha Bunn. The wild olive forms one of the principal forest trees in Khampoor (of Huzara). Waving over sites from which we turn up Grecian relics, it has often occurred to me that it may have been transplanted hither from Attica.

I may perhaps be accused of extravagance in fancying I can trace the course of the Macedonian conqueror in a singular custom prevalent throughout that tract. On the approach of a Chief or Governor, the women run together and sing poems in his praise. The chaunt is every where the same: but it is not often easy to catch the words. When I have succeeded, I have found them to consist in repetitions of "the conquering Raja, victorious in battle!" Grecian habits sit ill upon Hindu persons. The obligation to be bashful, imposed by eastern decorum, struggling with a determination to maintain a privilege not always agreeable to their Lords, drives the women together in clusters, with faces to the centre: whilst the display of untidy linen and the ravages of time upon such faces as are visible, are dangerous to a reader of Macbeth. Nevertheless the custom is decidedly derived from the followers of Bacchus or of Alexander. On first entering Kote, one

of the towns of Huzara, at a time when the appearance of a British Officer was a welcome sight, I observed two old crones upon a housetop, hiding their faces in one another's rags, whilst one of them beat either a tambourine or a parchment sieve and both screamed in chorus. Here, on the Hydaspes, the villages near Alexander's crossing are dangerous of approach owing to this custom, as it is made an excuse for demanding a douceur. In Huzara it is a spontaneous tribute of respect.

This paper, excepting a few corrections, was written in April last upon the Hydaspes, previous to the appearance of Captain A. Cunningham's interesting correspondence in the February number of the Journal of the Asiatic Society. It was detained owing to some errors in the measurements of my native surveyors, and subsequently by the disturbed state of the Punjab. Whenever my opinion may differ from that of so distinguished an antiquary, it is offered with hesitation. Had his leisure allowed him to visit the Maha Bunn, I think he would agree with me that it is the only mountain upon the Indus answering to Arrian's description of Aornos. And that if it be not the identical mountain, the site must be sought for upon the Loondi river. This would reconcile the difficulty arising from Quintus Curtius' statement of 16 marches from Ekbolima to Atok. From Umb, at the foot of Maha Bunn to Atok, not above 8 marches intervene. As, however, neither Arrian, nor Quintus Curtius had seen the country they describe, and as both wrote long after the events they record, their itineraries are not very certain guides, and accordingly Quintus Curtius brings Alexander to Nicæa previous to the capture of Aornos, whilst Arrian reverses the order of events. Quintus Curtius on the other hand brings Alexander to Ekbolima after the capture of Aornos, whilst Arrian states that he took part there to reduce the rock.

Aornos is always styled by Arrian η πετρα, the Rock, and certainly the sense of the historian would seem to apply this term to the mountain upon which the Fort was built. Such a term would scarcely have suited the Maha Bunn, which is essentially a mountain and not a rock, albeit scarped at summit with precipices. But on the other hand, it is difficult to imagine any mere rock answering to the description of the historian as abounding in fountains, springs and forests, with arable land for a thousand ploughs and pastures for the hundreds of thousands of cattle of the plains. Such are the attributes of a mountain and not of a rock. I therefore infer that Aornos is a name applicable only to the

castle itself and its basement rock. The ruined castle of the Maha Bunn appears to have been sited upon a square, rock some 50 or 60 feet high, springing from the table summit, scarped to eastward with tremendous precipices, having a ravine to the north and an inferior mound beyond it, and being protected on the other quarters by its own precipitous sides.

Bearing in mind that the Macedonians, themselves mountaineers, were fresh from the conquest of a land abounding in the loftiest and most rugged mountains, and from the storm of several mountain strongholds, I should hesitate to allow that they could have mistaken a hill of one thousand feet, for a mountain of four thousand. The Maha Bunn, by a rude triangulation of bearings, and a ruder observation with the sextant, I made upwards of 5,000 feet higher than the river at its base. Arrian reckons the height of Aornos at 11 stadia or 4125 feet above the plain. And this altitude, if measured at all, must have been computed by means of instruments far ruder than mine. The great and pre-eminent attitude of the mountain is all we can elicit from the reading. There is no mountain comparable with the Maha Bunn upon the right bank of the Indus within twenty miles farther north, a distance too great for the circumstances narrated. Opposite Maha Bunn, and across the Indus, is a rocky curb to the valley, called Durbund, the only site in this neighbourhood to which I have ever heard the name of Alexander attached. The attack upon Aornos appears to me to have occurred in April or May; for the passage of the Hydaspes was effected in July and from Aornos to the Hydaspes, are about 20 short marches. Owing to the great heat of the plains, the Maha Bunn, retains its snow only one third of the period usual to mountains of similar altitude, distant from the plains. By the end of March or earlier the snow is melted from its summit.

Capt. Cunningham's identification of the Dumtour district with the Urasa of Indian history is the more happy, that he does not seem to have been aware, that it still retains the name Aorush. But he would probably not have supposed it the Varsa Regio of Pliny, had he been aware that the huge table mountain of sandstone upon the right bank of the Hydaspes about 35 miles above Dhangalli is to this day called Nurr Varsova, a name which at once arrests the attention by its identity with that of the Polish capital. The Sutti however of this Var-

sova bear not the slightest resemblance to the Sarmati of the Polish Varsova. Their origin is uncertain. They call themselves aborigines and are undoubtedly one of the oldest tribes hereabouts. It was from the pine forests of Varsova that Alexander must have constructed the celebrated fleet by which he wafted his army to the mouths of the Indus.

These observations are offered with deference to the able and accomplished officer with whose conjectures I have sometimes presumed to differ. They are presented as the suggestions of a Pioneer who has been over ground which Capt. Cunningham's leisure did not admit of his visiting, and are insisted upon only so far as they recommend themselves to his judgment.

I see that in the map of that prince of topographers, Arrowsmith, whose delineation of the features of the Punjaub is beyond all praise, one of the Swant mountains is designated Aornos: but I know not upon what authority :—whilst in other maps a Nicetta (quære the long sought Nicæa), appears upon the Loondi R.

The rivers Kooner and Loondi may, indeed, by a certain latitude of interpretation, be called the springs of the Indus, and the people of Bajoor (the Bezira besieged by Alexander), would naturally retreat to the Swant mountains.

But it appears to me necessary to the consistency of the narrative, that Aornos should be sited upon the Indus, and I think it quite impossible that so famous a retreat of the turbulent Affacini as the Maha Bunn should have been passed unnoticed by Arrian.

I must however observe, that people of Bajore assure me there is a mountain upon the spot indicated by Arrowsmith's map, of the following description. It stands upon the right bank of the river Loondi. It is girdled to the south and east with stupendous cliffs, which give it the aspect rather of a castle* than of a mountain. Its summit is the abode of the Siah-posh Kawfurs, who maintain such vigilant watch, that no stranger can enter without their permission. It is quite unassailable and forms the principal path of communication between Bajore and the Siah-posh Kawfur country. There is also another mountain of not less altitude than the Maha Bunn, standing about 20 miles to the

* Terræque motu coactum absistere—says Quintus Curtius, was the popular tradition of Aornos.

north-west of the latter, extremely precipitous and apparently isolated, but not I think of extent sufficient to agree with Arrian's description. It is called Elum and stands upon the limit of the Maha Bunn and Sohaut districts. A subordinate summit of the Maha Bunn overhangs Khubl on the west bank of the Indus. It is about 2000 feet higher than the river Indus, peaked at summit, extremely steep and covered with forest. Its name is Aonj which the Greeks would probably write Aornos, but there is no record of its ever having been crowned with a fort, though the remains of a temple are there. The position of Rani ka Kote was pointed out to me. It is one of the inferior processes of the Maha Bunn. There is not a doubt that the sculpture of which fragments remain is Indo-Greek. At the foot of the Maha Bunn on the western brink of the Indus, and at the highest point accessible to an army is the celebrated castle of Umb, the stronghold of the late Poynda Khan and now of his son Jehandád Khan. Mr. Vigne thinks this the Umbolima of Arrian which Quintus Curtius writes Ekbolima: but although the position agrees sufficiently well with that of the historian, I have vainly endeavored to discover any rock or village in the neighbourhood called Balimah. Such a rock exists on the western bank of the Jelum, above Dhangulli. It is crowned with a castle or rather Tower, in which Chuttur Singh is said to have deposited his wives. Those who have seen Nicetta assure me there is no hill in the neighbourhood of more than 500 feet altitude.

The disturbed state of the country has for the present put a stop to personal research: but I hope the roads will soon again be open.

J. Abbott.

P. S. We must look to the Pushtoo names of places with regard to their identification with those mentioned by the Greek historians. Thus Peyshawur is to this day called Peykawur, in Pushtoo, i. e. by the Eusafzyes and establishes the right long acknowledged to be the Peukelaotes of Arrian.

Route from Káthmándú, the capital of Népál, to Darjeling in Sikim, interspersed with remarks on the people and country, by B. H. HODGSON, *Esq.*

1st Stage to Choukót, East, 7¼ cos.

Proceeding viâ Mángal, which is within a ¼ mile of the city, we came to Nangsál, at the like distance from Mángal. Both are petty suburban Néwár villages. Thence to Deopátan, distant ¾ cos, a large pakka* village inhabited by Néwárs. Thence to Thémi, 1¼ cos. Thémi is a considerable pakka town of Néwárs, and is famous for its pottery. Thence to Bhátgáon, distant one cos; Bhátgáon is a large handsome Néwár town situated near the eastern end of the valley of Népál, and is said to contain 12000 houses. Its palace, temples and tanks are very striking structures. Thence to Sángá, 2 cos. This bridge-like place stands on a low ridge separating the great valley of Népál proper from the subordinate valley of Banépa. It is a small place, but the houses are all pakka, as usual with the Néwárs. Thence to Banépa, one cos. Banépa is a small pakka town inhabited by Néwárs, and situated in the vale of the same name. Thence to Khanarpú, one cos. It is a nice little Néwár village, situated near the point where the dales of Banépa and Panouti blend with each other. Thence to Choukót, ¼ cos, ascending a low ridge and quitting the level country thus far traversed, and all of which is highly cultivated, yielding autumn crops of rice and spring ones of wheat.

2nd Stage to Kálápáni, East, 6 cos.

Ascend the large ridge of Batásia and come to the mountain village of Phúlbári, which is somewhat less than one cos from Kálápáni. Thence along the ridge 2¼ cos to Syámpáti, another small village of Parbatias. Thence to Saláncho, one cos. Saláncho is a third small hill village, and it overlooks the glen of Káshi Khand on the left. Thence to Kánpúr, a Parbattia village, close to which is the halting place, at a tank called Kálápáni, distant from Mithya Kót 1¼ cos.

* Pakka here means built of burnt bricks. This word and its correlative Kachcha are most convenient terms for which I know no English equivalents.

3rd Stage to Jhángá jhóli, South East, 6½ *cos.*

This stage runs along the same ridge of Batásia. But it is here called Ténnál. Half a cos to the hill village of Bohatia, and another half cos to that of Gimti, both inhabited by Múrmis. Thence ½ cos to Pokri, another similar village of Múrmis. Thence to Chápá Khár, about ¾ cos, a fourth Múrmi village. Thence to Gárchá, another hamlet of Múrmis, distant from the last rather less than 2 cos; ¼ cos more brings one to the descent into the Biási or vale of Dúmja, on the banks of the Rósi and Sún Cósi. The Biási is low, hot and malarious, but fertile in rice, triangular in shape, and about a mile in greatest width. The Bar, Pipal, Sémal and Khair trees* grow here, and large Dhanéses (Buceros Homrai) are seen eating the fruit of the Pipal. The Sún Cósi at Dúmja flows freely over a wide bed of sand, and is about 40 yards broad and one foot deep. This river, if the Milanchi be regarded as its remotest feeder—arises from the eastern side of Gosainthán, the great snowy peak overlooking the valley of Népál, and is the first of the "seven Cósi" (sapt Cósi) of the Népálese. Others contend that the true Sún Cósi is that which arises at Kálingchok east of Kúti.† There are several upper feeders of the Sún Cósi which form a delta, of perhaps 30 cos either way, between Milanchi, Kálingchok and Dallálghát, where the feeders are all united. From Dúmja, which lies a little below Dallálghát, proceed along the right bank of the river Sún Cósi to Jhanga-jhóli, by the rugged glen of the river 2 cos, the road impeded by huge masses of rock lying half in the water.

4th Stage to Sital-páti, East, 4 *cos.*

Leaving the river on the left you ascend the ridge of Sidhak and travel along its side, far from the top, to the village of Dharma, inhabited by Múrmis. It is 1½ cos from Jhanga-jhóli. Thence half cos to Jhámpar, a village of Múrmis. Thence descending again to the bed of the Sún Cósi you proceed along the right bank for one cos to Chayanpúr-phédi, or the base of the Chayanpúr range. Thence an ascent of one cos to the top of Chayanpúr where stands the Powa or small Dharamsála of Sital-páti, the halting place, and which is close to the village of Choupur.

* The occurrence of the Indian figs, cotton tree, and acacia, so far within the mountains, shows that the Biásis, wherever situated, have a tropical climate. See on.

† See annexed Memorandum and sketch Map.

5th Stage to Liáng, East, 6 cos.

Two cos along the heights of Chayanpúr bring you to the confluence of the Támba Cósi and Sún Cósi, where the united rivers, of nearly equal size before their junction, are passed at Séliaghát, a little below the Sangam or junction. The Támba Cósi, or second Cósi of the Népálese, has its source at the base of Phallák, a Himálayan peak situated some ten cos perhaps east of the Kúti pass, which is on the great eastern high road from Káthmándú to Lassa. From Séliaghát the road makes a rapid ascent of one cos to the high level or plateau of Gumounia, one cos along which conducts you to Bhalaiyo, which is only another name for the same plateau. From Bhalaiyo-dánra, one cos to Bétiáni village, still along the plateau. Thence one cos along the same high level to the halting place or Liáng-liáng which is a large village well inhabited chiefly by Néwárs. Some Parbatias also dwell there, and there is plenty of cultivation and water on the flat top of this low ridge, which is neither mountain nor plain.* The rice called Touli by the Néwárs grows well, and wheat, and generally all the field and garden produce of the valley of Népál.

6th Stage to Narkatia, South East, 4½ cos.

One and half cos along the plateau of Liáng-liáng, you come to Bhirpáni, having the Dápcha and Manthali glens on the left, by which there is another road, used chiefly in the cold season. Thence at half a cos you descend slightly to Wádi Khóla, a small hill stream, and passing it make the great ascent of Hiliapáni and reach Lámágáon after one cos of climbing. Close to the village of Lámágáon is another called Sálú, inhabited by Parbatias.† Thence one cos to the Likhú Khóla, a slight descent. Thence a small ascent to Bhálú-dánṛa or the Bear's ridge, half a cos along which brings you to the village of Nigália or Narkatia, the halting place. The Likhú Khóla is the third Cósi of the Népálese. It is a large unfordable river which is crossed by a bridge, but is smaller than the Sún Cósi or Támba Cósi. It comes nearly due south from the snows at Kháli Múngali, and forms one of the seven chief feeders of the great Cósi.

7th Stage to Báj-bisounia, East, 3 cos.

Still along the Bear's ridge ½ cos to the small village of Láchia, and another half cos to the village of Chúplú. Thence quit the ridge and

* See note at stage the ninth. † For tribes of Népál, see Journal for Dec. 1847.

by a slight descent reach Phédi Khóla, at 1¼ cos. Phédi Khóla is a small feeder of the Molang. Pass the stream and ascending slightly for one cos reach the halting place which is a village of good size, where plenty of provisions may be had.

8th Stage to Búngnám Kót, East, 4 *cos.*

Along the same low ridge to the village of Sailiáni, close to which you come successively to the villages of Chilounia and Pokhalia and Aisiálú, all within the compass of less than one cos. Beyond Aisiálú, 1½ cos, is a small pond, the water of which, though not rising from rock, never fails. Its name is Dhimilopáni, and on its left runs the ridge of Thária-dáṇra and Katonjia village; on its right, the Bhanda ridge and the village of Jaljalia. Beyond Dhimilopáni commence a descent of somewhat less than a half cos leading to the Molang or Morang Khóla, before named. Cross the Khóla and ascend one cos to Búngnám Kót, a large village and residence of the rural authority, having the smaller village of Bari on its right.

9th Stage to Chúrkhú, East, 6 *cos.*

After one cos of descent reach the Lipia Khóla, which stream you cross at once and ascend the Lipia-dáṇra or ridge, travelling along which you soon come to Okal-dhúnga, a village of Bráhmans and Khas. Thence to Jyá-miria, another village close by on the right. Thence going a cos you reach Charkhú-dáṇra, merely another name for the Lipia ridge. Descending slightly and advancing one cos you come to Rúmjátár, a celebrated and extensive pasture tract, where the Gúrúng tribe feed large flocks of sheep (Ovis Barúál.)* Thence 2¾ cos of slight descent to Dhanswár, the head village of the rural arrondissement, where the Dwária, or deputy of Rankésar Khatri, who holds the village in private property, resides. Had the village belonged to the first, would have been called, as the Dwária's abode, not Dhanswár but Kót.

* The more general character of Társ is described in the sequel. This one must be very unusually lofty and cool, else neither Gúrúngs nor their sheep could dwell in it. It is probably only a cold weather place of resort. Otherwise it must be 5 to 6000 feet high, like the plateau of Liáng, spoken of at stage 5. Both are exceptional features of the country, which nevertheless with all its precipitousness, has more numerous, diverse and extensive level tracts than is commonly supposed.

10th Stage to Háchika, East, 6 cos.

After half a cos of descent we arrived at Thotnia Khólá, a hill torrent which joins the Dúd Cósi about 3 miles ahead. Proceeded down the rugged stony glen of the Thotnia to the junction, which is reached at Rasuá ghát. Thence down the right bank of the Dúd Cósi for 2 cos to Katahar Biási, where the river, which had thus far run through a narrow glen incumbered with boulders, has a wider space on either bank, capable of cultivation and yielding fine crops of wet rice, but hot and malarious. This sort of tract is what is called in the Parbatia language a Biási. Katahar Biási belongs to bráhmans, who dwell on the heights above. The road leads down the Biási, which is above half a cos wide, for more than one cos, and then ascends the ridge of Kúvindia for one cos to the halting place or Háchika, which is a village inhabited by Kirántis, whose country of Kiránt is bounded on the west by the Dúd Cósi, and begins on this route where the Dhanswár estate ends. The Arún is the eastern boundary of Kiránt. The Dúd Cósi is the fourth great feeder of the Mahá Cósi, which latter enters the plains as one river at Váráhá Kshétra above Náthpúr in Purneah. We have already passed three of these great tributaries or the Sún Cósi, the Támba Cósi, and the Likhú Cósi. The remaining ones are three, or the Arún Cósi, Barún Cósi and Tamór Cósi.* Thus there are seven in all: and eastern Népál, or the country between the great valley and Sikim, is called Sapt Cousika, or region of the seven Cósis, from being watered by these seven great tributaries of the Mahá Cósi. Kiránt and Limbúán are subdivisions of the Sapt Cousika, so called from the tribes respectively inhabiting them; the Kirántis dwelling from the Dúd Cósi to the Arún; and the Límbús from the Arún to the Tamór. The country between the great valley and the Dúd Cósi is not so especially designated after the tribes inhabiting it. But the Néwárs and Múrmis of Népál proper are the chief races dwelling there. Of all these tribes the Néwárs are by much the most advanced in civilization. They have letters and literature, and are well skilled in the useful and fine arts. Their agriculture is unrivalled; their towns, temples and images of the gods, are beautiful for materials and workmanship; and they are a steady, industrious people equally skilled in handicrafts, commerce and the culture of the earth. The rest of the highland tribes or people are fickle, lazy races, who have no

* See Memorandum at the end of the Itinerary and annexed Sketch.

letters or literature, no towns, no temples nor images of the Gods, no commerce, no handicrafts. All dwell in small rude villages or hamlets. Some are fixed, others migratory, cultivators perpetually changing their abodes as soon as they have raised a crop or two amid the ashes of the burnt forest. And some, again, prefer the rearing of sheep to agriculture, with which latter they seldom meddle. Such are the Gúrúngs, whose vast flocks of sheep constitute all their wealth. The Múrmis and Magars are fixed cultivators; the Kirántis and Limbús, for the most part, migratory ones: and the Lepchas of Sikim still more completely so. The more you go eastward the more the several tribes resemble the Bhótias of Tibet, whose religion and manners prevail greatly among all the tribes east of the valley of Népál, though most of them have a rude priesthood and religion of their own, independent of the Lámás.

11th Stage to Sólmá, South East, 3 cos.

Leaving Háchika, which is itself lofty, you ascend for 2 cos through heavy forest by a bad road exceedingly steep to the Kiránti village of Dórpá, which is situated just over the brow of the vast hill of Háchika, the opposite side of which however is far less steep. Going half a cos along the shoulder of the hill you then descend for half a cos to the village of Sólmá, the halting place.

12th Stage to Lámakhú, East, 2½ cos.

An easy descent of one cos leads to Lapché Khóla, a small stream, which crossed you ascend the ridge of Lámakhú via Gwálúng, a Kiránti village situated near its base. Thence the acclivity of the hill is steep all the way to the halting place, which is about half way to the hill top, and 1½ cos from Gwálúng. Lámakhú is a Kiránti village like Gwálúng but smaller.

13th Stage to Khíka Mácchá, East, 4 cos.

Descend half a cos to the Sápsú Khóla, a petty stream, which however the Kirántis esteem sacred. Cross it and commence ascending the great mountain Tyám Kyá. Climb for one cos by a bad road to the village of Kháwa, and another cos equally severe to Chákhéva bhanjáng, or the ridge, and then make an easy descent of one and half cos to Khíka mácchá, the halting place. It is a village of Kirántis in which a mint for coining copper is established by the Durbar of Népál. The workmen are Bánras (Bandyas) of the valley of Népál, of whom there

may be 50 or 60. There is also a Taksári or mint master, and a squad of 25 soldiers under a jemadar.

14th Stage to Jinikhésáng, East, 5 cos.

After a cos of tolerably easy travelling you come to Júkya Khóla, a petty stream, which passed, you arrive in half a mile at Pakri, a village situated at the base of the Khokan ridge. Thence slightly descending for half a cos reach Pikhúá Khóla. Cross it and ascend the hill of Bhaktáni for one cos and reach Múrkiahúlák, a post station of the Government close to the 66th mile* stone of the great military road leading from Káthmándú nearly to the frontier. Thence a descent of one cos to the Khésáng Khóla, one of the innumerable small mountain streams. Cross the Khóla and ascend the ridge of Thaklia for half a cos to Bánskim and Powagaon, two small conjunct villages of Kirántis. Thence along the ridge of Khésáng for $1\frac{1}{4}$ cos to Jinikhesáng, a large Kiránti village, the head of which is Balbhadra Rai, and whence there is a very fine view of the snows.

15th Stage to Jarai tár, South East, $5\frac{1}{2}$ cos.

Descending slightly for $1\frac{1}{2}$ cos reach Yákú village, and then descending more abruptly for one cos, come to the Ghongaria Khóla, a small stream. Cross it and proceed along the nearly level base of the Yákú ridge for two cos and a half, to Jarai tár, a large village inhabited by Kirántis, Khas and bráhmans, and situated at the opening of an extensive and cultivated flat running along the right bank of the Arun river, and raised some 30 or 40 cubits above the level of its bed. Such an elevated flat is called in the Khas tongue a Tár, whereas a low flat or one on the level of the river is termed a Biási. Every great river has here and there Társ or Biásis, or both.† Társ, from being raised are

* The route gives 61. The difference of 5 cos is owing to the travellers making an occasional short-cut, for they kept, generally, the great military highway.

† It is remarkable how universally this phœnomenon of high and low levels of the land, indicating change in the relative heights of the land and water, prevails wherever obvious sedimentary deposits are found in definite locations. Herbert and Hutton in their reports of the geology of the Western sub-Himálayas, perpetually speak of the phœnomenon as occurring in the mountains, and, according to Herbert, also in the Dúns and even Bháver; and Darwin (Naturalist's Journal) constantly records it in the course of his long survey of South America from Rio Janeiro to the north point of Chili.

The same thing is very observable in the great valley of Népál, whose whole surface is almost equally divided into high and low levels, though the operating

Low ridge of Chobhár in the valley of Nepal with the desiccating cleft therein and the river nearing it.
The great range of Chandragiri in the distance.

usually too dry for rice, but some can be well irrigated from the adjacent mountain, and then they will produce rice as well as Biásis. If not constantly irrigable, wheat, barley, millets, pulse and cotton are grown in them. The elevation of Társ is too inconsiderable to exempt them from malaria, though they are usually rather more wholesome than the lower and often swampy Biásis. Jarai tár is an extensive one, being 1½ cos wide, and, as is said, several miles long, following the river. The soil is red but fertile, and the whole of it is under cultivation. The village is large for the mountains, and has some 50 to 60 houses, some of which are pakka, as a caravansery here called Dharamsála or Powa, and one or two more. The site of the village is higher than the rest of the Tár. The Pinus longifolia abounds in Jarai tár and peacocks are very numerous. Also jungle fowl* and Káliches (Gallophasis melanoleucos).

16th Stage to Pákharibás, South East, 2½ cos.

Proceeding half a cos you come to the ferry of the Arún, which is a large river rising in Bhot, passing the Himáchal above Hathia, and forming the main branch of the great Cósi. It is also the conterminal limit of Kiránt and Limbúán. It is passed at Liguaghát by boat, and is there very rapid and deep, and some 30 to 40 yards wide. Thence down the left bank of the Arún for 1 cos to Mángmá, a village inhabited by Kirántis and Limbús, being on the common frontier of both tribes. Thence quitting the Arún you reach the Mángmá Khóla in ¼ cos, and crossing it proceed half a cos along the mountain side (manjh) to Ghórli Kharak, which is the name of a small village, and also of a celebrated iron mine, the workers of which dwell above the line of road. A vast quantity of fine iron is procured. This mine, like all others in Nepál,

cause must here have been modified in its action, as indeed is perpetually the case in different localities. The high and low levels of Tár and Biási, I consider to represent the pristine and present beds of the rivers, whose constant erosion has during ages created this difference of level, often amounting to 150 or 200 feet. The low level of the valley of Népál I consider to have been suddenly scooped out when the waters of the pristine lake (for such the valley was) escaped in one tremendous rush under the action of an earthquake, which rent the containing rock and let off the waters at once.—(See accompanying sketch.)

* From these indications, which are altogether exceptional as regards the mountains, it may be confidently stated that Jarai tár is not more than 1500 feet above the sea.

is the property of the government. Iron and copper abound in Népál. Most of the iron is consumed in the magazines for the army or otherwise within the country. But a deal of the copper is exported and forms a good part of the pice currency of the plains on this side the Ganges. The Nepalese are very military. Khas, Maghar, Gúrúng and even bráhmans, except those of the priesthood, constantly wear sidearms of home manufacture; and the large army of the State is furnished with muskets, swords, and Khúkris from native ore. Thus much iron is consumed, so that none is exported, at least none in the unwrought state, possibly because from defective smelting the ore becomes hardened by the accession of fumes of charcoal, and is thus rendered unfit for those uses to which soft iron is applied. From Ghórli Kharak, an ascent of quarter cos to Pakharibás, the halting place, which is a Gúrúng village, large but scattered, according to the wont of that tribe.

17th Stage to Dhankúta, South East, 2½ cos.

After a severe ascent of a cós and half a wide flat-topped mountain is gained, whence there is a fine view of the plains, and on the top of which is a small lake, very deep, and about half a cos in circumference. Its name is Hilia, and the water is clear and sweet. Thence a steep descent of one cos brings you to Dhankúta, distant from Káthmándú 78 standard* cos by the great military road, as recorded on the mile-stone at Dhankúta. Dhankúta is the largest and most important place in Eastern Népál, and the head-quarters of the civil and military administrator of all the country east of the Dúd Cósi† to the Sikim frontier, excepting only what is under the inferior and subordinate officer stationed at Ilám, who has a separate district bounded towards Dhankúta by the Tamór river. Bijaypúr, Cháyanpúr, Mánjh-Kiránt and a great part of the Limbuán are subject to Dhankúta, where usually resides a Kaji or Minister of the first rank, who likewise commands the troops stationed there. After defraying the local expenses, he remits annually nine lakhs of revenue to Káthmándú. Towards the plains

* The itinerary gives 71½ cos. The difference has been explained in a prior note. The standard cos of Népál is equal to 2¼ English miles.

† The central administration extends to the Dúd Cósi. See essay on the laws and legal administration of Népál in the Transactions of the Society, Vol. 17, and Journal of Royal Asiatic Society.

the jurisdiction of Dhankúta extends over the old Bijaypúr principality, and towards the hills, over the country of the Kiránts and Limbús. But both the latter tribes are poor at once and impatient of control, so that the Nepal Government is content with a lax general submission and a light revenue levied and paid through the Rais or native heads of those tribes. And this is the reason why only nine lakhs are remitted from Dhankúta to Káthmándú. The present Governor of Dhankúta is a colonel, and brother to the Premier Jang Bahadur Konwar. There is a cantonment, a powder manufactory, a parade ground at Dhankúta, where the Sri Jang regiment, 500 strong, is now stationed. The place owes its origin to the Gorkáli dynasty, and is therefore recent; but it is growing fast into a town, the pakka houses being already numerous, and the tradesmen and craftsmen abundant, active and skilful. Provisions are plentiful and cheap, and the workers in Kánsa (mixed metal) are celebrated for the excellence of their commodities, many of which find sale so far off as Kathmándú. The Kirántis and Limbús, who constituted the soldiery or militia of the former Bijoypúr state, pay to the Ghorka Government annually in lieu of all other taxes and claims, 7½ rupees per house or family. The houses or families are large, so that each can cultivate a great extent of ground. But how much (or little) soever they may raise, each family is free on payment of the annual fixed assessment, which the Rais above noticed collect and deliver. The Rais also administer Police and Justice among their own people in all ordinary cases. Capital crimes are referred to the governor of Dhankúta, who must have the Durbar's sanction for every sentence of death or confiscation. Dhankútá overlooks Bijoypúr, the old capital of the Eastern Makwáni or Bijaypúr Principality, which stands on the skirts of the Tarai of Morang, but within the hills; and no part of the low lands (Madhés) is subject to the Governor of Dhankúta. The Madhés is administered by Súbahs, of whom there are seven for the whole.*

18th Stage to Bhainsia tar, south east, 6 cos.

A sharp descent of one cos brings you to the banks of the Tamór, which is a large river, though less than the Arún. It is never fordable and is crossed in boats. It is very deep, rapid, but not clear, and about

* The 7 zillahs of the Népálese lowlands, which extend from the Arrah to the Mechi, are Morang, Saptari, Mahótari, Rotahat, Bára, Parsa and Chitwan.

30 cubits wide between the hot weather banks. This is the seventh and last of the great feeders of the Cósi, which it joins at Tirbéni, a holy place of pilgrimage, so called from its being the point of union of the three rivers, Tamór, Arún and Sún Cósi.* The Tamór rises from the Western aspect of Káng cháng júnga. We crossed the Tamór in a boat, and then proceeded half a cos down its left bank. Thence, quitting the river. you skirt the base of the Máć hill for one cos to the Tankhudá nadi, a small hill stream. Cross it to Mámagá tár, and then travel through this fine extensive flat for two cos. The whole is cultivable, and the most part cultivated by Dénwárs and Mánjhis, and it is situated on the banks of the Tamór, to which the winding of the road again brings you. Quitting the Tár you advance a quarter of a cos to the Rasua Khóla, which forded, you proceed along the base of the Télia ridge for 1¼ cos to another Tirbéni and place of pilgrimage, where the Cherwa and Télia rivers join the Tamór at Cherwa ghat. A great fair is annually held at Cherwa, to which traders go even from Káthmándú. Thence proceeding a ¼ cos you reach the halting place or Bhainsia tár. The tar may be ½ cos wide and one cos long. It is very hot and malarious, and is inhabited by the Mánjhi tribe.

19th Stage to Lakshmipúr, E. N. E. 5 cos.

A quarter cos of slight ascent brings you to the Nawa Khóla, a moderate-sized stream, which is ascended for 3 cos by a very bad road that crosses the bouldery bed of the river many times. Thence quitting the Khóla you commence the severe ascent of Lakshmi chúria, which is climbed incessantly till you reach the halting place near the hill top. Lakshmipúr is a large and flourishing village of Limbús, where men and goods abound, and the climate is fine and the water cold—a great relief after the burning Társ recently traversed.

20th Stage to Ybháng, East, 3 cos.

After a slight descent of 1½ cos you come to Pokharia Khóla, a small stream which is at once crossed. Thence a slight ascent of one cos up the ridge of Nángi, along the top of which another half cos brings you to the halting place, which is a Khas village of large size.

* Of the seven Cósis, the Támba and Likhú are lost in the Sún Cósi, and the Barún in the Arún, the latter, far above the route. Tirbéni is immediately above Báráha Kshetra before noticed, as the point where, or close to which, the united Cósis issue into the plains.

21st Stage to Khándráng, East, 4 cos.

A slight ascent of ½ cos to the village of Múléi, inhabited by Khas. Thence a great descent of one cos to Kokalia Biási, or the Magpie's glen, which is watered by the Déó mai, a small stream. Cross it and ascend the ridge of Timkyá a short way, and then skirting along its waist (mánjh) for 1¼ cos come to the Léwá Khóla, another of the innumerable streamlets of the hills. Cross it and proceed for 1½ cos along the base of the ridge of Khándráng to the village of the same name, which is the halting place and a small village of bráhmans.

22nd Stage to I'lám, East, 5 cos.

Descend the Khándráng ridge for half a cos and come to a small stream called the Ratia Khóla. Cross it and then make a severe ascent of one cos up to the ridge of Gólákharak, whence Karphók, the great ridge dividing Nepál from Sikim, is visible. Thence an equally difficult descent of 1 cos to the I'lám Khóla, a small stream. Thence, crossing the stream, make the severe ascent of Tilkiáni ridge for 1¼ cos. Thence skirt along the side of the hill (mánjh) for 1 cos to the halting place or I'lám, which is a small fort designed to guard the eastern frontier of Népál. The Chatelain is a Captain and has 100 soldiers under him, with 8 artillerymen and one cannon of small calibre. This officer is also the civil authority of the arrondisement and raises the extraordinary revenues thereof to meet the local expenses, sending the balance, if any, to Kathmándú. The land revenue is wholly assigned to his troops in pay.

23rd Stage to Gódhak, East, 2 cos.

After a steep descent of one cos you come to the Jógmai or Mai river, a small stream, which passed, you commence the steep ascent of Gódhak, and continue ascending to the halting place, which is a small village of bráhmans half way up the hill.

24th Stage to Siddhi, North-East, 3 cos.

Detained much by rain to-day and yesterday, and therefore made short marches. Leaving Gódhak ascended by a very bad road loaded with dense vegetation for 1¼ cos to Karphók chouki, a frontier Gorkháli post, where 8 soldiers always reside. Thence one cos along the ridge or Lékh to Súdúng, which is but another name for the ridge. Thence a slight descent of one cos to the Siddhi Khóla, a small stream, on the banks of which we halted on account of the rain.

25th Stage to the English Chouki, N. E. 7½ cos.

Crossed the Siddhi stream and proceeded 1½ cos of slight ascent and skirting the mountain bases to Thaplia. Thence half a cos of descent to the small streamlet of Séchideu. Thence a quarter cos over low hills to the Méchi river. The Méchi is the present boundary of Népál and Sikim. It is a small stream which rises in the Singalélah ridge, a spur of Karphók. Crossed it and ascended the hill of Nágri, by a very bad road and severe ascent of 1¼ cos to the top. Thence a severe descent of one cos to the smaller Rangbhang Khóla, a streamlet merely. Thence along the glen to the great Rangbhang, distant one cos. Thence a steep ascent of one cos to Nágri Kót, an old fort in ruins. Thence a painful descent of ½ cos to the Balason river. It is a moderate sized stream, larger than the Méchi. Thence half a cos of rather uneven travelling to the halting place.

26th Stage to Darjeling, North, 4 cos.

A severe ascent of one cos, and then an easy half cos along a ridge, brought us to the Company's high road, along which we travelled for 2½ cos to Jellapahár and Herbert hill at Darjeling.

Total cos 109.

At 2⅓ miles per cos=miles 254.

NOTE.—The Nepalese standard cos is equal to 2⅓ English miles, and the travellers had this standard to refer to along a great part of their way, as being coincident generally with the measured military road several times adverted to on the route. Hence their distances from stage to stage may be perfectly relied on, though in the details of each stage the same accuracy cannot be expected.

Memorandum relative to the seven Cósis of Népál, by B. H. HODGSON, Esq.

The enumeration of the seven Cósis by the Itinerists is doubtless the accredited one, and what I have myself often heard at Kathmándú. Nevertheless names are not always applied in strict correspondence with things in geography. Witness the neglected Jáhnavi, the true and transnivean source of the Ganges! Now, if we are to estimate the seven chief feeders of the great Cósi according to the length of their

courses, or their effect on the physiognomy of the country, the enumeration ought seemingly to be as follows:—

1st. The Milamchi. 2nd. The Bhotia Cósi. 3rd. The Támba Cósi. 4th. The Likhú Cósi. 5th. The Dúd Cósi. 6th. The Arún. 7th. The Tamór.	Local series beginning from the West.

This list omits the Barún of the usual enumeration, and substitutes the Bhotia Cósi for the Sún Cósi: and not without Nepalese authority for both changes, for it is very generally allowed that the Barún hardly belongs to the Sub-Himálayas, and that Sún Cósi is rather the name of the general receptacle of the Cósis till joined by the Arún, than that of a separate Cósi. The following remarks on each river will make this apparent.

1st. The Milamchi rises above the Bhotia village of that name, and at or near to the eastern base of Gosainthan, the great snowy peak overlooking the valley of Népál. From the snows the Milamchi has a south-eastern course of probably 60 miles to Dallál ghát. It is joined from the west by the Sindhu, the Tánd, and the Chák, and from the north and north-east by the Indrávati, the Balamphi and the Jhári. The three former are petty streams; but the three latter are considerable ones, one of them rising in the snowy region, and another having two subordinate affluents. The Indrávati comes from the Hemáchal at Panch pokri and flows nearly due south into the Milamchi below Hélmú. The Balamphi and Jhári have only sub-Himálayan sources, situated south-east of Panch pokri, but they have longer independent courses than the Indrávati before they unite, after which they presently join the Milamchi not far above the confluence of the Chák. The subordinate feeders of the Balamphi above adverted to, are the Boksia and Lipsia. They have short parallel courses W. S. W. into their parent stream. Thus the Milamchi is a notable river, and it is the more so as forming very distinctly the western boundary of the basin of the great Cósi, of which the equally distinct eastern limit is the Timór.

2nd. The Bhotia Cósi has its sources at Deodhánga, a vast Himálayan peak situated some 60 or 70 miles east of Gosainthán and a little

north and east of the Kúti pass, being probably the nameless peak which Colonel Waugh conjectures may rival Kángchángjúnga in height. The river flows from the base of Deodhúnga past the town of Kúti, and has a S. West direction from Kúti to Dallál ghát, where it joins the Milamchi after a course about as long as the Milamchi's,—the two rivers, of nearly equal size, forming a deltic basin. In about its mid-course the Bhotia Cósi is joined by the Sún Cósi from Kálingchok. But Kálingchok is no part of the true Hemáchal, nor is the stream thence flowing equal to that coming from the snows at Deo dhúngá. Consequently the name Bhotia Cósi should prevail over that of Sún Cósi as the designation of one of the separate seven Cósis, and the name Sún Cosi be reserved for the general receptacle, within the mountains as far east as Tirbéni. The Bhotia Cósi is joined at Listi by the Júm Khóla, whilst from the Mánga ridge another feeder is supplied to it, much lower down or below the confluence of the Sún Cosi, from the east. But as the Milamchi below the junction of the Balamphi and Jhári is often called the Indrávati vel Indhani, so the Bhotia Cósi below the junction of the Sún Cósi is frequently styled by the latter name, which others again with more reason confine to the more general confluence below Dallál ghát. *There* no doubt the name Sún Cósi begins to be well applied, it being universally the designation of the great receptacle of waters running W. and E. from Dúmja to Tirbéni. At Dúmja, which is only a few miles south of Dallálghát, the Sún Cosi receives a considerable affluent from the west. This affluent is called the Rosi. It rises on the external skirts of the great valley under the names Biyabar and Panouti, from the respective dales watered by the two steamlets.

3rd. The Támba Cósi. It rises at Phallák in the snowy region, about two journies east and a little north of Kálingchok, or the fount of the upper and pseudo Sún Cósi. The Támba Cósi's course from Phallák to Sélaghat, where it falls into the receptacle, is nearly south, and as far as I know it has only one considerable affluent, which is the Khimti. The Khimti rises in the Jiri ridge and flowing nearly south, parallel to the Támba Cósi, joins the latter in its mid-course at Chisapáni.

4th. The Likhú. This river is less than the Támba Cósi and seems to rise somewhat beneath the snows, though its place of origin at Kháli Mungali is said to be a ridge connected therewith. Its course is still more directly south than that of the Támba Cósi, to which however its

general direction is very parallel. I know but one of its feeders, the Khâni, which comes from the Cháplú ridge on the east of the main river.

5th. The Dúd Cosi. It is a large stream, larger even than the Támba Cósi, though inferior to the Arún or Támor. It rises amid the perpetual snows, but at what exact spot I do not know, and it has a southern course to the Sún Cósi at Rasua. Its feeders are numerous. But I know only those near Rasua, which are the Thotia and the Sisnia on the west, and the Rao on the east.

6th. The Arún or Arún Cósi. It is the largest by much of the whole, and consequently the main source of the Maha Cósi, having several feeders in Tibet, one from Darra on the north, another from Tingri on the west, and a third from the east from a lake. The Arún is not only the greatest of the Cósis but of all the Sub-himálayan rivers, if the Karnáli be not its equal. None other can compete with it. The Barún, often reckoned a separate Cósi, is a mere feeder of the Arún and joins it so high up that there is little propriety in admitting the Barún as a member of the Sapt Kosi. The Barún is lost in the Arún in the Alpine region, at Hatia, the great mart for the barter trade of the Cis and transniveans by the very accessible pass of the Arún. Lower down the Arún receives many tributaries—from the west, the Salpa and Ikhua—from the east, the Sawai, the Héngwa, the Pilwa, the Ligua, and the Mámagá. Its course on this side the Himálaya is generally north and south; but in Tibet it spreads to the west and east also, covering and draining a deal of ground there.

7th. The Tamór Cósi. The Tamór also is a very fine river, inferior only to the Arún. It is alleged to have more than one trans-himálayan source. It passes the snows at Wállúng chúng, or arises there from the snows. Its course from Wállúng to the general junction at Tirbéni is south-west, and it receives many affluents on the way, as the Wállúng, the Chúng, the Yángmá, the Méwa, the Kabaili, the Kháwa, the Nhabo, the Tankhua, the Teliá, the Nava, the Chérwa, the Kokaya.

To this appendical memorandum on the Cósis I subjoin a sketch of the several primary feeders of the so called Sún Cósi, made from my own observations as well as enquiries. I have no personal knowledge of the rest of the "Sapt Cousika." Indeed no European has yet set foot in this region save myself on the western, and Dr. Hooker on the eastern, margin. We may shortly expect much information from Dr. H. as to the latter, or the skirt confining with Sikim.

On the Chépáng and Kúsúnda tribes of Népal, by B. H. Hodgson, *Esq.*

Amid the dense forests of the central region of Népál, to the westward of the great valley, dwell, in scanty numbers and nearly in a state of nature, two broken tribes having no apparent affinity with the civilized races of that country, and seeming like the fragments of an earlier population.

"They toil not, neither do they spin;" they pay no taxes, acknowledge no allegiance, but, living entirely upon wild fruits and the produce of the chase, are wont to say that the Rajah is Lord of the cultivated country as they are of the unredeemed waste. They have bows and arrows, of which the iron arrow-heads are procured from their neighbours, but almost no other implement of civilization, and it is in the very skilful snaring of the beasts of the field and the fowls of the air that all their little intelligence is manifested.

Boughs torn from trees and laid dexterously together constitute their only houses, the sites of which they are perpetually shifting according to the exigencies or fancies of the hour. In short, they are altogether as near to what is usually called the state of nature as any thing in human shape can well be, especially the Kúsúndas, for the Chépángs are a few degrees above their confreres, and are beginning to hold some slight intercourse with civilized beings and to adopt the most simple of their arts and habits. It is due, however, to these rude foresters to say that, though they stand wholly aloof from society, they are not actively offensive against it, and that neither the Government nor individuals tax them with any aggressions against the wealth they despise or the comforts and conveniences they have no conception of the value of.

They are, in fact, not noxious but helpless, not vicious but aimless, but morally and intellectually, so that no one could without distress behold their careless unconscious inaptitude. It is interesting to have opportunity to observe a tribe so circumstanced and characterised as the Chépángs, and I am decidedly of opinion that their wretched condition, physical and moral, is the result, *not* of inherent defect, but of that savage ferocity of stronger races which broke to pieces and outlawed both the Chépáng and the Kúsúnda tribes during the ferocious ethnic struggles of days long gone by, when tribe met tribe in internecal strife contending for the possession of that soil they knew not how to fructify! Nor

A man of the Chépáng Tribe.

T. Black, Asiatic Lith. Press Calcutta

is there any lack of reasonable presumptions in favour of this idea, in reference to the Chépángs at least; for the still traceable affiliation of this people (as we shall soon see), not less than the extant state of their language, demonstrates their once having known a condition far superior to their present one or to any that has been their's for ages.

That the primitive man was a savage has always appeared to me an unfounded assumption; whereas that broken tribes deteriorate lamentably we have several well founded instances in Africa.* Quitting however these speculations I proceed with my narrative. During a long residence in Nepal, I never could gain the least access to the Kúsúndas, though aided by all the authority of the Durbar: but, so aided, I once, in the course of an ostensible shooting excursion persuaded some Chépángs to let me see and converse with them for 3 or 4 days through the medium of some Gúrúngs of their acquaintance. On that occasion I obtained the accompanying ample specimen of their language; and, whilst they were doling forth the words to my interpreters, I was enabled to study and to sketch the characteristic traits of their forms and faces.† Compared with the mountaineers among whom they are found the Chépángs are a slight but not actually deformed race, though their large bellies and their legs indicate strongly the precarious amount and innutritious quality of their food. In height they are scarcely below the standard of the tribes around them‡—who however are notoriously short of stature—but in colour they are very decidedly darker or of a nigrescent brown. They have elongated (fore and aft) heads, protuberant large mouths, low narrow foreheads, large cheek-bones, flat faces, and small eyes. But the protuberance of the mouth does not amount to prognathous deformity, nor has the small suspicious eye much, if any thing, of the Mongolian obliqueness of direction or set in the head. Having frequently questioned the Durbar whilst resident at Káthmándú as to the relations and origin of the Chépángs and Kúsúndas, I was invariably answered that no one could give the least account of them, but that they were generally supposed to be autochthones, or primitive inhabitants of the country. For a long time such also was my own opinion, based chiefly upon their physical characteristics as above noted

* Prich. Phys. Hist. Vol. II. passim. Scott's exquisite Novels throw much light on this subject.

† See the accompanying outline, which is remarkably faithful and significant.

‡ Magar, Múrmi, Khás, Gúrúng, Néwár.

and upon the absence of all traceable lingual or other affinity with the tribes around them. So that I took the Chépángs, the Kúsúndas and the Haiyus, a third tribe, remarkably resembling the two former in position and appearance—to be fragments of an original hill population prior to the present Tibetan original inhabitants of these mountains; and to be of Tamulian extraction, from their great resemblance of form and colour to the Aborigines of the plains, particularly the Kóls. It did not for several years occur to me to look for lingual affinities beyond the proximate tribes, nor was I, save by dint of observation made, fully aware that the Mongolian type of mankind belongs not only to the races of known northern pedigree, such as the mass of the sub-Himálayan population,* but equally so to all the Aborigines of the plains, at least to all those of central India. Having of late however become domiciled much to the eastward of Káthmándú, and having had more leisure for systematic and extended researches, those attributes of the general subject which had previously perplexed me were no longer hindrances to me in the investigation of any particular race or people. I now saw in the Mongolian features of the Chépángs a mark equally reconcileable with Tamulian *or* Tibetan affinities; in their dark colour and slender frame, characteristics at first sight indeed rather Tamulian than Tibetan, but such as might, even in a Tibetan race, be accounted for by the extreme privations to which the Chépángs had for ages been subject; and in their physical attributes taken altogether I perceived that I had to deal with a test of affinity too nice and dubious to afford a solution of the question of origin. I therefore turned to the other or lingual test; and, pursuing this branch of the inquiry, I found that with the southern Aborigines there was not a vestige of connexion, whilst to my surprise I confess, I discovered in the lusty† Lhópás of Bhútán the unquestionable origin and stock of the far removed, and physically very differently characterised, Chépángs! This lingual demonstration of identity of origin, I have for the reader's convenience selected and set apart as an Appendix to the vocabulary of the Chépáng language; and I apprehend that all persons conversant with ethnological enquiries will see in the not mere resemblance but identity of thirty words of prime use and necessity extracted from so limited a field of comparison

* See Journal for December last. I date their transit of the Himálaya from Tibet fully 1200 years back.

† See the subjoined note at the end.

as was available for me to glean from, a sufficient proof of the asserted connexion and derivation of the Chépángs, notwithstanding all objections derivable from distance, dissolution of intercourse and physical nonconformity. But observe, the last item of difference is, as already intimated, not essential but contingent, for both Lhópá and Chépáng are marked with the same essential Mongolian stamp, whilst the deteriorations of vigour and of colour in the Chépángs, though striking, are no more than natural, nay inevitable, consequences of the miserable condition of dispersion and out-lawry to which the Chépángs have been subject for ages anterior to all record or tradition. And again, with regard to local disseveration, it should be well noted, in the first place, that by how much the Chépángs are and have long been removed from Bhútán, by so much exactly do conformities of language demonstrate identity of origin, because those conformities cannot be explained by that necessary contact with neighbours to which the Chépáng language owes of course, such Hindi, Parbatia and Newár terms as the vocabulary exhibits; and, in the second place we must recollect that though it be true that 300 miles of very inaccessible country divide the seat of the Chépángs from Bhútán, and moreover that no intercourse therewith has been held by the Chépángs for time out of mind, still in those days when tribes and nations were, so to speak, in their transitional state, it is well known that the tides of mankind flowed and ebbed with a force and intensity comparable to nothing in recent times, and capable of explaining far more extraordinary phœnomena than the disruption of the Chépángs, and their being hurried away, like one of the erratic boulders of geologists, far from the seat of the bulk of their race and people. Indeed, the geological agents of dislocation in the days of pristine physical commotion may throw some light, in the way of analogy, upon the ethnological ones during the formative eras of society; and, though we have no record or tradition of a Lhópá conquest or incursion extending westward so far as, or even towards, the great valley of Nepal, we may reasonably presume that some special clan or sept of the Bhútanese was ejected by an ethnic cataclysm from the bosom of that nation and driven westward under the ban of its own community alike, and of those with which it came in contact in its miserable migration, for misfortune wins not fellowship.

The lapse of a few generations will probably see the total extinction of the Chépángs and Kúsúndas, and therefore I apprehend that the

traces now saved from oblivion of these singularly circumstanced and characterised tribes, now for the first time named to Europeans, will be deemed very precious by all real students of ethnology. Their origin, condition and character are, in truth, ethnic facts of high value, as proving how tribes may be dislocated and deteriorated during the great transitional eras of society.

Addendum on Bhútán.

Lhó is the native name for Bhútán, and Lhópá and Dúkpá (written Brúkpa) are native names for an inhabitant of Bhútán—whereof the former is the territorial, the latter, the religious, designation. In other words, a Lhópá is one belonging to the country of Bhútán, and a Dúkpá (rectè Brúkpa), a follower of that form of Lamaism which prevails in Bhútán, and which has become equally distinctive with the local designation for an inhabitant of the country, since the people of Bhót or Tibet were converted to the new or Gélúkpá form of that faith. Bhútán is a Sanscrit word, and is correctly Bhútánt, or 'the end of Bhót' (inclusively), the brahmans like the natives, deeming the Cisnavian region an integral part of Tibet, which it is ethnographically, though by no means geographically. Had Klaproth and Ritter been aware that Lhó is Bhútán, and Lhópá an inhabitant of Bhútán, we should not have had their maps disfigured by a variety of imaginary regions placed East of Bhútán and termed Lokabadja, &c. a sheer variorum series of lingual error resting on the single local name Lhó and its derivatives of a personal kind, as correctly and incorrectly gathered by them. Originally some Bengáli rendered Lhó by the, to him, familiar word Lók (regio); and then, being unaware that the Tibetan affix bá vel pá means belonging to, inhabitant of, he subjoined to the bá his own equivalent of já (born of) and thus was deduced Klaproth's furthest error (I omit others short of this one) of Lokabadja. To trace an error to its source is the best way to prevent its repetition, an aphorism I add, lest any person should suppose me wanting in respect for the eminent persons whose mistake I have pointed out. Klaproth was possibly misled by Hastings' letters to and from Téshúlúngba.* But he and Ritter are fairly chargeable with constant creation of new regions out of mere synonyma! I could give a dozen of instances from their splendid maps.

* See Turner's Embassy and native account of Bhutan, in the Society's Transac-

Vocabulary of the language of the Chépáng.

English.	*Chépáng.*	*English.*	*Chépáng.*
The world	Caret,	Winter	Namjúng
God	*Nyam Ding	The rains	Nyamwá
Man	Púrsi	Grain	Yam
Woman	Mírú	Rice, unhusked	Yáng
Quadruped	Syá	Rice, husked	Chúí
Bird	Móá	Wheat	Kan
Insect	Pling	Barley‡	Caret
Fish	Gna T	Plantain	Maisé
Fire	Mí T	Pear	Pásai
Air	Máró	Tobacco	Mingo
Earth	Sá T	Pepper	Marich H
Clay, plastic	Sá lena	Red pepper	Raksai
Water	Tí	Garlick	Bin
Light, lux	Angha	Oil	Sáté
The Sun	Nyam T	A tree	Sing-tak T
The Moon	Lámé T	A leaf	Ló T
The Stars	Kar T	A flower	Ró
A mountain	Rías T	A fruit	Chai
A plain	Dáni	Wood	Sying T
A river	Ghoro	Fuel	Jháro sying
A ferry	Titachaparna? (fold)	Grass	Caret
A boat	Caret	Straw	Won
A bridge	Tá	Bran	Rók
Husband	Palam	A horse	Sérång
Wife	Malam	An ox	Shyá
Father	Pá	A bull	You shyá
Mother	Má	A cow	Mó shyá
Brother	Hou	A buffalo	Misha T
Sister	Hou dhiáng	A dog	Kúi T
Grand-father	Tó	A cat	Caret
Grand-mother	Aió	A monkey	Yúkh
Uncle	Páng	A jackal	Karja
Aunt	Múm	A tiger	Já
Child	Chó	A leopard	Mayo já
Boy	Chó	A bear	Yóm
Girl	Chó riáng	A goat	Micha
Kinsfolk	Laikwo	A sheep	Caret
Strangefolk	Sáïng	A hare	Caret
Day	Nyi Gni T	A hog, pig	Piak T
Night	Yá	An elephant	Kísí N
Dawn	Wágo	A deer	Kasya
Noon	Syáwa	A rat	Yú
Evening	Nyam rama	A mouse	Mayo yú
To-day	Tén	A manis	Cháng júng
Yesterday	Yon	A fowl (gallus)	Wá
To-morrow	Syáng	Its egg	Wá-kúm
A week	Caret	A pigeon	Bak-wá
A fortnight	Bákha yatlá	A crow	Káwá
A month	Yatlá	A sparrow	Yúrkúnwá
A year†	Yatang	A lark	Bajú wá
Summer	Lhapa	A partridge	Títhara H

* Nyam is the Sun, which is no doubt worshipped, and hence the identity of terms.

† The separate 12 months and 7 days have no names.

‡ No other grain named but wheat and rice.

English.	*Chépáng.*
A quail	Úmbá-wá
A kite or hawk	Mó-wá
A fly	Yang
A bee	Túmbá
The human body	Mhá
The head	Tolong
The hair	Min
The face	Khén
The forehead	Jyél
The eye	Mik T
The nose	Gné Nyé
The mouth	Móthong
The chin	Kám-tyó
The ear	Nó T
The arm	Krút
The hand	Kútpá
The leg	Dom
The foot	Caret
The belly	Túkh
Bone	Rhús T
Blood	Wí
Blood-vessel	Só
A house	Kyim T
A door	Kharók
A stone	Báng
A brick	Caret
A temple	Ding tháni
An idol	Simtá
Dinner	Amjia
A dish	Ló
A plate	Mila
Flesh	Mai
Bread	Lang
Vegetables	Kyáng
Honey	Túm
Wax	Maiṉ P
Milk	Gnútí
Gheu	Gheu H
Cloth	Nai
Clothes, apparel	Nai
Bed clothes	Lou
Upper vest	Doura
Lower vest	Súmbá
Shoe	Panai P
Stocking	Dócha P
Wool, raw	Min
Cotton, ditto	Kapás H
Hemp, ditto	Kyou
Bow	Lüï
Arrow	Láh T
Ax	Wárhé
Spade, hoe	Taik
Plough	You sing
Loom	Caret
Knife	Phiá ghúl
Brush, broom	Phék
Basket	Tokorong
Rope, thick	Rá

English.	*Chépáng.*
Cord, thin	Rhim
Thread	Mayo rhim
Needle	Gyap
Pen	Ré syáng
Ink	Hildang
Sovereign	Rájah H
Subject	Parja H
Citizen	Béráng moy
Countryman, rustic	Bó moy
Soldier	Gal moy
Villager	Désing moy
Priest	Jhákri
Physician	Chimó
Druggist	O'sa yilong
Master	Sing chopo
Servant	Mayo ? (small)
Slave	Gráng
Cultivator	Kámin chara
Cowherd	Góthála H
Carpenter	Sing kami N
Blacksmith	Kami N
Weaver	Naik yousa
Spinner	Rhim rhousa
Taylor	Rúpsa
Basket-maker	Gráng kióni
Currier	Pún rúpo
Tanner	Pún lai
Cotton-dresser	Rhim rhowan
Iron	Phalám P
Copper	Támba H
Lead	Sísa H
Gold	Liáng
Silver	Rúpá H
Rain	Nyóng wá
Frost	Chépú
Snow	Rápáng
Ice	Chépú
Fog	Khású
Lightning	Marang
Thunder	Marang múra
A storm	Maṛhú
A road	Liam T
A path	Mayo liam
A spring (water)	Tíshakwó
Trade	Yinláng
Capital	Rás
Interest	Chó
Coin	Tanka H
Robbery	Latiláng
Theft	Ditto
Murder	Jénsatáng
Rape	Kútyáláng
Cultivated field	Blú
City or town	Béráng
Village	Dési N
Horn	Róng T
Ivory	Laik
A still	Káti póng

English.	*Chépáng.*	*English.*	*Chépáng.*
Beer	Han	Stupid	Waiva chúl
Spirits	Rakshi P	Honest	Waba pina
The senses	Caret	Dishonest	Waba pilo
Touching	Dina ?	Great	Bronto
Smelling	Gnama ?	Small	Maito, Mayo
Seeing	Yorsa ?	Heavy	Lito
Hearing	Saisa ?	Light, levis	Caret
Tasting	Yangsa ?*	Black	Gálto
Hunger	Rúng	White	Bhámto
Thirst	Kióp	Green	Phelto
Disease	Róg H	Blue	Gálto
Medicine	O'sá N	Red	Dúto
Fever	Aimang	Yellow	Yérpo
Dysentery	Boárláng	Sweet	Nimto
Small-pox	Bróm	Sour	Nimlo
Fear	Rai	Straight	Dhimto
Hope	Áphró	Crooked	Dóngto
Love	Mharláng	Hot	Dháto
Hate	Ghrim náng	Cold	Yéstho
Grief, sorrow	Manbharáng	Dark	Caret
Joy	Yang náng	Light, luminous	Takto
One	Yá-zho	Great	Bronto
Two	Nhi-zho T	Greater	Mhák talto
Three	Súm-zho T	Greatest	Mhak tálto
Four	Plói-zho	Small	Maito
Five	Púma-zho	Smaller	Cholam
Six	Krúk-zho	Smallest	Cholam
Seven	Chana-zho	To stand	Chimsa
Eight	Práp-zho	To fall	Chónsa
Nine	Takú-zho	To walk	Whása
Ten	Gyib-zho	To run	Kisa
Half	Bákhá	To climb	Jyáksa†
The whole	Yágúr	To question	Hótsa
Some, any	Caret	To answer	Dyengnúksa
Many	Jhó	To request	Bajhináng ?*
None	Dómánalo	To refuse	Bainanglo ?
Near	Lóktó	To fight	Kaichináng
Far	Dyángtó	To kiss	Chopchináng
Blind	Mikchángna	To laugh	Nhísa
Lame	Domtonga	To cry	Rhiása
Dumb	Nósa chúl	To eat	Jhicháng
Deaf	Nósa mal	To drink	Túmcháng
Clean	Bhangto	To talk	Nhocháng
Dirty	Gálto	To be silent	Ashimanga ?
Strong	Jokto	To shit	Yésháng
Weak	Joklo	To piss	Chúcháng
Good	Pito	To ascend	Jyákcháng*
Bad	Pilo	To descend	Súsyáng
Ugly	Pilo	To cut	Palchináng
Handsome	Dyángto	To break	Tléscháng
Young	Dyáng mai	To join, unite	Chócháng
Old	Burha H	To jump	Jyéscháng
Clever	Chimo	To sit down	Múcháng

* Sá I think is the infinitive sign, and áng the participial. And one or other should appear uniformly here.

† If as I suppose, Sá be the infinitival sign there must be error and the rather that all the verbs should have one form. Áng I think is the participial sign.

English.	*Chépáng.*	*English.*	*Chépáng.*
To stand up	Chingsa	To write	Résa
To sleep	Yémsa	To read	Brósa
To wake	Tyoksa	To sing	Mansa
To give	Búïsa T	To dance	Syáksa
To take	Lísa T	To lie down	Kontimúsa
To lend	Búïsa	To get up	Caret
To borrow	Lísa	To tell a falsehood	Hekaktáng
To buy	Yingsa	To see	Chéwáng ?
To sell	Yinlángalsa	To hear	Saiyáng ?*
To exchange	Gyésa	To taste	Lyémsa
To live	Caret	To smell	Namsa
To die	Caret	To touch	Dimsa
To reap	Rása	To count	Théngsa
To sow	Wársa	To measure	Krúsa
To thresh	Rhápsa	To remember	Mhardangsa
To winnow	Krápsa	To forget	Mhoiyangsa

N. B.—**T** postfixed indicates a Tibetan etymon for the word, H a Hindi origin, P a Parbatia or Khas, and N a Néwár, ditto. It was not in my power to do more than collect vocables. I could not ascertain structure: but comparing all the words I conceive the anomalies of the verbs may be set right by assuming Sá to be the infinitival sign, and áng, varied to chang, yang and nang, the participial one.—B. H. H.

List of Chépáng words derived from the Tibetan language and especially the Bhutanese dialect of it.

English.	*Tibetan.*	*Lhopa.*	*Chépáng.*
Eye	Mig	,,	Mik
Sun	Nyimá	Nyim	Nyam
Sky	Namkháh	Nam	Nam
Ear	,,	Nó	Navó
Mountain	Rí	Rong	Rías
Star	Karma	Kam	Kar
Free	Jon-shing	Shing	Sing-tak
Wood	,,	Shing	Sing
Leaf	Ló-ma	,,	Ló
Salt	Tsá	Chhá	Chhé
Road	Lam	Lam	Liam
House	Khyim	Khim	Kyim
Moon	Lávo	,,	Lámé
Bone	Rúspa	,,	Rhús
Fire	Mé	Mí	Mí
Arrow	Dáh	Dáh	Láh
Dog	Khyi	Khi	Kúï
Buffalo	Mahi S	Méshi	Mísha
Day	,,	Nyim	Nyi
Earth	,,	Sá	Sá
Fish	Nyá	Gná	Gná
Hog	Phag	Phag	Piak
Horn	Rá	Róng	Róng
Two	Nyis	Nyi	Nhí-zho†
Three	Súm	Súm	Súm-zho
Give	Búh	Bin	Búï
Take	Lan	Ling	Lí

* These should be Chésa and Saisa I apprehend.

† Zho is a emunerative servile affix like Thampa in the decimal series of Tibetan.

A passage from Ibn Qotaybah's Adab al Kátib' on Arabic Astronomy; by A. SPRENGER. *Communicated by* H. M. ELLIOT, *Esq. Foreign Secretary to Govt. of India.*

We find in Arabic two sets of names for stars and constellations. Some are purely Arabic, like بنات نعش (the Bear), others are transcribed or translated from the Greek, as دب (the Bear), and قيقاوس a corruption of قيفاوس (Cepheus). In the same manner we find two totally distinct systems. In one (the purely Arabic) we find names for southern stars which are visible only in Arabia and not in Greece or Babylonia; the ecliptic is divided into twenty-eight parts, and not into twelve, and, consistently, the year has twenty-eight solar months; many stars have names of which the Greeks have not taken notice, and they are grouped into constellations in a manner different from that of the Greeks. This system of astronomy rests solely on observation without calculation or generalization.

Greek astronomy seems to have been first introduced among the Arabs by Khálid b. Yazyd, who flourished towards the end of the first century of the Hijrah; he had several books translated from the Greek into Arabic, and was in possession of a celestial globe which had been made by Ptolemy;* and so rapidly did this science take root and spread among the followers of Muhammed, that the Moors in Spain were, as early as the ninth century after Christ, the instructors of their northern neighbours. We find in the writings of the venerable Bede the words *Alidada* العضادة and *Almajest* المجسطى which bear witness to the Arabic origin of part of his astronomical knowledge. Ever since the time of Khálid, systematical writers on astronomy follow exclusively the Greek system, whilst encyclopædic authors mix the two without much discrimination. The chapter of Ibn Qotaybah on astronomy, though the tendency of the author is philology, is therefore very valuable; for he carefully excluded every Greek ingredient from it with the exception

* Kifty's Bibl. Philosophorum, the account of this (or globe) is in Casiri II. 417, but not complete: the passage ought to run

وكرة نحاس من عمل بطلميوس و عليها مكتوب حملت هذه الكرة من الامير
خالد بن يزيد بن معاوية و لنا ملنا ما مضى من زمانها فكان الفا و ما يتين
و خمسين سنة (compare the MSS. copy of Kifty in the Lib. of Paris).

perhaps of the names of the signs of the Zodiac, with which the Arabs were probably acquainted long before Muhammed.

The object of Ibn Qotaybah's* book called the Writer's Manual, ادب الكاتب or according to others اداب الكتاب, is merely to explain the words and terms which occur in the poems, proverbs, &c. of ancient Bedouin poets, we can not therefore expect complete explanations. To supply what I can, I have added some extracts from the *Mabáhij al Fikr* of Wat-wát وطواط of which I believe, there is no copy in Europe, the extracts from this book however must be received with some caution, for the author is not always critical, and the MSS. not always correct; but the extracts from Ibn Qotaybah may be completely relied upon, and they will be found copied under the respective heads in the Qámús and Ci*háh* and translated in Freytag's *Dict. Arab. Lat.*

معرفة فى السماء والنجوم و الازمان و الرياح

السماء كل ما علاك واظلك و منه قيل لسقف البيت سماء و السحاب سماء قال الله عزوجل و انزلنا من السماء ماءً مباركاً يريد من السحاب و الفلك مدار النجوم الذي يضمها قال الله عزوجلّ وكلٌ في فلك يسبحون سماه فلكا لاستدارته ومنه قيل فلكة المِغزال و قيل فلَّكَ ثدي المرءة و للفلك قطبان قطب فى الشمال و قطب فى الجنوب متقابلان ومُجَرّة السماء سُمِّيت مجرةً لانها كاثر المجرّ و يقال هي شَرَج السماء ويقال باب السماء وبروج السماء واحدها بُرْج و اصل البُروج الحصون و القصور قال الله تعالى و لوكنتم في بروج مُشَيَّدة و اسماؤُها الحَمَلُ و الثور و الجوزا و السرطان و الاسد و السنبله و الميزان و العقرب و القوس و الجدي و الدلو و الحوت و منازل القمر ثمانية و عشرون منزلا ينزل القمر كل ليلة بمنزل منها

* Died A. H. 276.

قال الله تعالى والقمر قدّرناه منازل حتى عاد كالعُرجون القديم والعرب تزعم ان الانواء لها وتسميها نجوم الاخذ لان القمر ياخذ كل ليلة في منزل منها والازمنة اربعة ازمنة الربيع وهو عند الناس الخريف سمته العرب ربيعا لان اول المطر يكون فيه وسماه الناس خريفا لان الثمار تخترف فيه ودخوله عند حلول الشمس براس الميزان ونجومه من هذه المنازل الغَفَرُ والزُّباني والاِكْلِيلُ والقَلْبُ والشَوْلة والنَعَايم والبَلْدة ثم الشّتاء ودخوله عند حلول الشمس براس الجدي ونجومه سَعْد الذابح وسَعْد بُلَع وسَعْد السُعود وسَعْد الاَخْبِيَه وفَرْغُ الدَلْو المقدَّم وفرغ الدلو الموخَّر والرِّشاءُ ثم الصَّيْف وهو عند الناس الربيع ودخوله عند حلول الشمس براس الحمل ونجومه الشَرطانُ والبُطَيْنُ والثُرَيّا والدَّبْرانُ والهَقْعَةُ والهَنْعَةُ والذّراعُ ثمُ القَيْظ وهو عند الناس الصيف ودخوله عند حلول الشمس براس السرطان ونجومه النَثْرة والطَرف والجَبْهة والزُبْرَة والصُّرْفَةُ والعَوّاء والسّماك ومعنى النوء سقوط النجم منها في المغرب مع الفجر وطلوع اخر يقابله من ساعته في المشرق وانما سمي نَوءًا لانه اذا سقط الغارب ناء الطالع يَنُوءُ نوءًا وذلك النهوض هوالنوء وكل ناهض بثقل فقدناً به وبعضهم يجعل النوء السقوط كانه من الاضداد وسقوط كل نجم منها في ثلثة عشريوما وانقضاء الثمانية والعشرين مع انقضاء السنة ثم يرجع الامر الى النجم الاول في إستيناف السنة المقبلة وكانوا اذا سقط نجم منها وطلع اخر فكان عند

ذلك مطرا و ريح او حَرّة او يرد نسيوه الى الساقط الى ان يسقط
الذي بعده فان سقط و لم يكن مطر قيل خوي نجم كذا و اخوي
و سِرَارُ الشهر و سِرَارُه اخر ليلة منه لاستسرار القمر و ربما استسرّ ليلة
و ربما استَسَرّ ليلتين و البرءُ اخر ليلة من الشهر سميت بذلك
لتبرء القمر من الشمس و المحاق ثلث من اخر الشهر سميت
بذلك لامّحاق القمر فيها او الشهر و النحيرة اخر يوم من الشهر
لانه ينحر الذي يدخل و الهلال اول ليلة و الثانية و الثالثة ثم هو
قمر بعد ذلك الى اخر الشهر و ليلة السواء ليلة ثلث عشرة ثم
ليلة البدر لاربع عشرة و سمي بدر المبادرته الشمس بالطلوع كانه
يعجلها المغيب و يقال سمي بدرا لتمامه و امتلائه وكل شيء ثم فهو
بدر ومنه قيل لعشرة الف درهم بدرة لانها تمام العدد ومنتهاه و منه قيل
عينٌ بدرة اى عظيمة و العرب تسمي ليالي الشهر كل ثلث منها
باسم فتقول ثلث غُرَر جمع غُرّة و غُرّة كلشيء اوله و ثلث نُفَل و ثلث
تسع لان اخر يوم منها اليوم التاسع و ثلث و عشر لان اول يوم منها
اليوم العاشر و ثلث بِيضٌ لانها تَبْيَضّ بطلوع القمر من اولها الى
اخرها و ثلث دُرَعٌ و كان القياس دُرْعٌ سُمّيت بذلك لاسوداد
اوايلها و ابيضاض سائرها و منه قيل شاة دَرْعَاء اذا اسودّ راسها
و عنقها و ابيض سايرها و ثلث ظلم لاظلامها و ثلث حنادس لسوادها
ثلث دأدى لانها بقايا و ثلث مُحاقٌ لامّحاق القمر فيها او الشهر و للشمس
مشرقان و مغربان و كذلك القمر قال الله عز وجل رب المشرقين .

و رب المغربين فالمشرقان مشرقا الصيف و الشتاء و المغربان مغربا الصيف و الشتاء فمشرق الشتاء مطلع الشمس في اقصر يوم من السنة و مشرق الصيف مطلع الشمس في اطول يوم من السنة و المغربان على نحو ذلك و مشارق الايام و مغاربها في جميع السنة بين ها ذين المشرقين والمغربين قال الله عزوجل رب المشارق والمغارب و سمى النجم نجما بالطلوع يقال نجم السِّنُّ اذا طلع و نجم النجم و سمى طارقا لانه يطلع ليلا و كل من اتاك ليلا فقد طرقك و منه قول هند بن عُتْبَةَ نحن بَنَاتُ طارِق نَمْشى على النمارق تريد ان ابانا نجم في شرفه و علوه قال الله تعالى و ما ادريٰك ما الطارق النجم الثاقب و سمى القمر قمر البياضه و الاقمر الابيض و ليلة قمراء اى مضئية و الفجر فجران يقال للاول منهما ذَنَبُ السِّرْحان و هو الفجر الكاذب شبه بذنب السِّرحان لانه مُسْتَدِقٌّ صاعد في غير اعتراض و الفجر الثاني هو الفجر الصادق الذي يستطير و ينتشر و هو عمود الصبح و يقال للشمس ذكاء لانها تذكو كما تذكو النار و للصبح ابن ذكاء لانه من ضوءها و قرن الشمس اعلاها و اول ما يبدو و منها في الطلوع و مواجبها نواحيها و اياه الشمس ضوءها و الدارة التي حول القمر يقال لها الهالة و الرياح اربع الشمال وهى التي تاتي من قبل الشام وذلك عن يمينك اذا استقبلت قبله العراق و هي اذا كانت بالصيف حارّة بارح و جمعها بوارح و الجنوب تقابلها و الصبا اتي من مطلع الشمس وهى القبول و الدبور تقابلها و كل ريح جاءت

بين مُبْهَّى ريحين فهي نكباء لانها نكبت اي عدلت عن مهابّ هذه الاربع و دراريّ النجوم عظامها و احدها دُرّيّ غير مهموز نسب الى الدر لبياضه و قال ابو محمد و من همز فقال دُرِيّ بالهمز اراد النجوم التي تطلع عليك و الجدى الذي تعرف به القبلة و هو جدي بنات نعش الصغرى و بنات نعش الصغرى بجنب بنات نعش الكبرى على مثل تاليفها اربعة منها نعش و ثلثة بنات فمن الاربعة الفرقدان و هما المتقدمان و من البنات الجدي و هو اخرها و السُّهى كوكب خفى في بنات نعش الكبرى و الناس يمتحنون فيه الصبارهم و فيه جرى المثل فقيل أُريها السُّهى و تُريني القمر و الفكّة كواكب مستديرة خلف السماك الرامح و العامة تسميها قصعة المساكين و قُدّام الفكّة السماك الرامح سمي رامحا بكوكب يقدمه يقولون هو رمحه و السماك الاعزل حد ما بين الكواكب اليمانية و الشامية سمي اعزل كانه لاسلاح معه كما كان للاخر و النسر الواقع ثلثة انجم كانها اثافي و بازايه النسر الطاير و هو ثلثة انجم مُصْطَفّة و انما قيل للاول واقع لانهم يجعلون اثنين منه جناحيه و يقولون قد ضمّهما كانه طاير وقع و قيل للاخر طاير لانهم يجعلون اثنين منه جناحيه و يقولون قد بسطهما كانه طاير و العامة تسميها الميزان و الكف الخضيب كف الثريا المبسوطة و لها كف اخرى يقال لها الجذماء و هي اسفل من الشرطين و العيوق في طرف المجرة الايمن على اثره ثلثة كواكب بينة يقال لها الاعلام و هي توابع العيوق و اسفل

العيوق نجم يقال له رجل العيوق و سهيل كوكب احمر منفرد عن الكواكب ولقربه من الافق تراه ابدا كانه يضطرب قال الشاعر أُراقب لوحا من سهيل كانه اذا ما بدا من اخر الليل. يطرف و هو من الكواكب اليمانية و مطلعه عن يسار مستقبل قبلة العراق و هو يرى في جميع ارض العرب ولا يرى في شئ من بلاد ارمينيه وبنات نعش تغرب بعدن و لا تغرب في شئ من بلاد ارمينيه و بين روية سهيل بالحجاز و بين روية بالعراق بضع عشرة ليلة و قلب العقرب يطلع على اهل الربذة قبل النسر بثلاث و النسر يطلع على اهل الكوفة قبل قلب العقرب بسبع و في مجرى قدمى سهيل من خلفها كواكب و ابيض كبار لا تري بالعراق يسميها اهل الحجاز الاعيار و الشعريان احدهما العبور وهي في الجوزاء والاخرى الغميصا و مع كل واحدة منهما كوكب يقال له المرزم فهما مرزما الشعريين والسعود عشرة اربعة منها ينزل بها القمر وقد ذكرناها و الستة سعد الناشرة و سعد الملك و سعد البهام و سعد الهمام و سعد البارع و سعد مطر وكل سعد منها كوكبان بين كل كوكبين منها في راى العين قدر ذراع وهي متناسقة فهذه الكواكب ومنازل القمر مشاهير الكواكب التي تذكرها العرب في اشعارها واما الخنس التي ذكرها الله تعالى في كتابه فيقال هي زحل و المشتري والمريخ و الزهرة و عطارد و انما سماها خنسا لانها تسير في البروج و المنازل كسير الشمس و القمر ثم تخنس اي ترجع بينا تري احدها في آخر البروج

كَرّراجعا الى اوله و سَمّاها كُنّساً لانها تَكْنِسُ اي تَسْتَتِر كما تستر الظباء و تكنس و الظباء اي تستتر *

"*On the heaven, stars, seasons, and winds.*"—"All which is above you is called samá (heaven); therefore the roof of the tent is called samá, and a cloud is called samá. It is said in the Qorân, "We have sent from the samá, i. e. from the cloud blessed water." Falak (sphere) is the name for the orbit of such stars as it contains. It is said in the Qorân 'They all swim in a falak.' The name falak has been chosen (to designate a sphere of the heaven) on account of its round shape; for you say the falkah (ball) of the spindle, you also say the breast of a woman became falak (round).

A sphere has two opposite holes; one in the south and one in the north.—The milkyway is called majarrah because it looks like a beam (supporting a vault); it is also called the sharaj (fissure) of heaven and the gate of heaven. The singular of borúj (signs of the Zodiac) is burj; it means fortress or castle (German, Burg); in this sense the word is used in the Qorân; 'If you are in strong boruj (fortresses).' The names of the signs of the Zodiac are: the ram, bull, transit, crab, lion, ear of corn, balance, scorpion, bow, goat, the water-basket, and the fish.

There are twenty-eight mansions of the moon. The moon is every day of the month in another mansion. It is said in the Qorân we have appointed for the moon mansions until she returns to her former place." The Bedouins were of opinion that the term "anwá" (heliacal settings), is exclusively applied to the mansions of the moon; and they called them the stars of occupation, for the moon occupies every night another mansion.

The year has four seasons: the autumn is now called (by the Arabs settled out of their native country) Kharyf; but the Bedouins called it Raby (fresh grass), for in that season falls the first rain. It is called Kharyf, because people cut their crops in that season. It begins when the sun enters Libra. The sun passes during this season through the following mansions of the moon: ghafr (occultation), zobány, iklyl (crown), qalb (heart), shawlaḥ (the curvature of a tail when raised), na'áyim (the ostriches), baldah (fissure).

Winter begins when the sun enters into the sign of Capricorn. He passes through the following mansions of the moon in this season: sa'd

al-dzábi*h* (the butchering luck), sa'd bola' (the devouring luck), sa'd al-so'úd (the luck of lucks), sa'd al-akhbiyah faragh al-dalw al-moqaddam (the foremost trough of the bucket), faragh al-dalw al-mowakhkhar (the hindmost trough of the bucket).

Spring was called çayf by the ancient Arabs, and Raby by the latter Arabs who had settled in cities. It begins when the sun enters into the sign of the Aries. Its mansions are: sharatán (the two signs or marks), botazn (the small belly), thorayyá (multitude, i. e. Pleiades), dabrán or dabarán (Hyades), haq'ah (the race-course), han'ah (the curvature), and dzirá (the forearm).

Summer was formerly called qaytz by the Bedouins, and is now called çayf by the towns-people. Its lunar mansions are: nathrah (the back of the nose, the stars are on the nose of the lion), *t*arf (the eye, viz. of the sign of the lion), jabhah (the forehead), zobrah (the lion's mane between his shoulders), çarfah (returning), 'awwá (the barker or dog), sinsák.

Nawö (heliacal setting), means that one of those stars sets (heliacally) in the west, whilst another rises (heliacally) in the east. The term nawö, which means rising, is used in this instance (for setting), because the setting of one of the mansions of the moon is always accompanied by the rising of another; some say that nawö means both rising and setting. One of the mansions of the moon sets (heliacally) and another one rises every thirteen days. The twenty-eight mansions make therefore their revolution once a year. If at the setting of a mansion of the moon a change of the weather took place, the Arabs used to ascribe it to the setting mansion, and they thought that it continued to influence the weather until the next mansion would set (the setting mansion, it must be recollected, proceeds towards coming in conjunction with the sun). If a mansion of the moon set and brought no rain it was called "empty."

Sirár or Sirar (occultation), is a term for the last night of the (lunar) month, for the moon becomes invisible, sometimes one and sometimes two nights. Barä (salvation), is equally the name of the last day of the month, for the moon escapes from the sun; mo*h*áq (destruction), is the name for the last three days of the (natural) month, for the moon perishes during them. Na*h*yrah (having the throat cut), is also a name for the last day of the month, for the coming mouth cuts the

throat of the going. The first three days after the moon has become visible she is called hilál, and the remaining days of the month the moon is called qamar. The thirteenth night of the month is called the night of equation, the fourteenth night is called the night of haste (full moon), for she hurries to overtake the sun before he sets and seems to drive him away. Some say that the word badr is to be taken in the meaning of 'completion or fulness' for the moon is then full, you use the word in this sense in calling a purse of 10,000 dirhams badrah, and in calling a full large eye badrah. Every three nights of the month had, with the Bedouins, a separate name. The first three were called ghorar, *plur.* ghorah, which means the first of any thing. The next three nights (4th, 5th, 6th) are called supererogations, the next three are called ninth, for the last of this three nights is the ninth of the lunar month; the next three are called tenth, from the first night of the set; and the next three (14th, 15th, and 16th) are called white on account of the silvery light of the moon, during these three nights, and the next three nights (17th, 18th, and 19th) dora' the regular form would be dor,' for the first half is dark and the other half is moonlight; you call a sheep dar'á if the head and neck is black and the rest of the body white. The next three nights (20th, 21st, 22d) are called dark, the next three (23d, 24th, 25th) are called black, dädiy, because they are a remmant, and the last three nights are called destruction, for the moon perishes.

The sun and moon have two orients and two occidents. It is therefore said in the Korân "God is the Lord of the two easts, and of the two wests." One is the place where the sun rises and sets in summer, and the other where it rises and sets in winter. The exact place of the east of winter is the point of the horizon where the sun rises in the shortest day of the year, and the east of summer is the point of the horizon where the sun rises in the longest day of the year. The other risings and settings of the sun are between these two extremes; the words (orients and occidents) are used in the plural in the Korân.

A star is called najm because it rises. You say of a tooth najama, i. e. it comes forth. You also say a star najama, i. e. it rises; a star is also called *táriq*, for it lights at night. You say of a man who comes to hue at night taraqa, in this sense, says the poetess, Hind b. (bint?) 'otbah: We are the daughters of a *táriq*, we walk on carpets. She

means to say our father is a star in nobility and height of position. "What do you know of the meaning of *táriq*? it is a bright star."

The moon is called qamar because she is white; aqmar means white; you say of the night it is qamrâ if it is light. There are two dawns, the first is also called the tail of the wolf, it is the false dawn and resemble a wolf's tail, because it is narrow and does not spread; the second is the true dawn which spreads, this is the red of the morning. The sun is called glowing for he glows like fire. The morning is hence called the morning of the glowing, (i. e. sun.) The highest part of the sun, which first rises above the horizon is called the horn of the sun. His sides are called hawájib; iyáh is the light of the sun; hálah means the halo of the moon.

There are four cardinal winds: the north wind which comes from Shám (left); or from the right if you are in the 'Iraq and place your face towards the qiblah. If the north wind is hot in summer it is called trying. The opposite wind is called south wind. The east wind comes from whence the sun rises, and the west wind comes from the opposite direction. A wind which comes from between two cardinal points is called declinating.

A large star is called dorriyy without a hamzah (pearly). Abú Muhammed says if you pronounce the word dorriyy with a hamzah and say doriy, it means a star which rises over you.

By the jady (polar star) through which you ascertain where the qiblah is, the jady of the ursa minor is meant. The ursa minor is close to the ursa major and resembles it; four stars are called na'gh (bier) and the other three are called banát (daughters). The first two of the four are called farqadán (the two calves), the last of the banát is called jady (polar star, literally, he-goat).—Sohá is an obscure star in the larger Bear on which people exercise their eyesight, and hence the saying: I show her the sohá (talks on subtilities) and she shows me the moon. Fakka (languor) is a round constellation (Corona borealis) behind the Arcturus the common people ('ámmah, and not ghilmah, as Freytag seems to have read) call it the poor man's cup. Before Arcturus is the simák rámih, (i. e. the simák armed with a spear;) it is called armed with a spear because there is a star before it which is called spear. The unarmed simák (Spica virginis) is between the southern and northern stars. The setting vulture consists of three

stars disposed like a julha (i. e. a fire-place consisting of three stones placed like a horse-shoe); opposite is the flying vulture which consists of three stars in a line. The former is called the sitting vulture, for two of its stars are considered as its wings; and it is conceived that the vulture has shut its wings like a bird that sits down. The latter is called the flying vulture, for two stars are considered as expanded wings, resembling those of a flying bird. The common people call this constellation the balance.—The tattooed hand is the open hand of the Pleiades. This constellation has another hand which is called the cut hand and which is below the sharatán. The 'ayyúq is on the right (south) side of the milkyway, behind it are three clear stars called marks. The lowest star of the 'ayyúq is called the foot of the 'ayyúq. Canopus is a red isolated star, as it is near the horizon it appears always twinkling. The poet says "I see a board from the Canopus which when it rises towards the end of the night, resembles a twinkling eye. This is a southern star, a man who faces in the 'Iráq the qiblah sees it to his left. It is visible in all Arabia but it is not visible in Armenia. The Bear sets in Aden but never sets in Armenia. You see the Canopus about ten days sooner in the *H*ijáz than in the 'Iráq. The heart of the Scorpion rises in the country of Rabadzah (which is four days journey from Madynah) three days sooner than the vulture, but at Kúfah the vulture rises before the heart of the Scorpion by seven days. On the track and behind the two feet of Canopus are large white stars, which are not visible in 'Iráq, and which are called Áyár in the *H*ijáz. Two constellations are called shi'rah (canis), one is called the shi'rá of setting over (the river), (i. e. canis major), and is in the Gemini, the other is called the shi'rá with sore eyes (canis minor). The canis major and minor have each a star called mirjam.

Ten stars are called sa'd (luck); four of them are among the mansions of the moon, and have been mentioned; the remaining six are: luck of the second grass, luck of the king, luck of the chickens, luck of the hero, luck of the distinguished, luck of the rain. Every one of these sa'd consists of two stars which are apparently one cubit from each other. They are regular, and these stars and the mansions of the moon are well known, and frequently mentioned by the ancient Arabic poets.

The Khonnas (retrograde) mentioned in the Qorán, is said to mean,

Saturn, Jupiter, Mars, Venus and Mercury, they have this name, because they move through the zodiac and mansions, like the sun and moon, but then they return; when you see one at the end of the zodiac it returns to the beginning. They are also called konnas, for they conceal themselves like "gazelles in their dens."

The word nawö, helical setting of a mansion of the moon, (plur. anwá,) is of frequent occurrence in Arabic authors, and several of them have written monographies on the anwá, to which the changes of the weather were ascribed, as with us to the quarters of the moon; yet this term seems to have escaped the diligence of Ideler, and its meaning has baffled the learning of Richardson and Freytag; the former explains it: "setting in the west (as a star) in the twilight, another one rising in the east." A passage from Watwát, which bears on the meaning of this term, may therefore be useful.

The mansions of the moon alternately watch each other. The term watching is employed, because one indicates the rise of another, as if one was waiting the setting of its fellow before it rises. The reason is this. The mansions are divided into two sets (or halves) as we have said, viz. the southern, which comprizes fourteen mansions, and the northern, which comprizes the same number. When the first mansion of the southern half rises, the first mansion of the northern sets. The first mansion of the northern set is the sharatán, and the first mansion of the southern set is the ghafr. When the sháratán rises the ghafr sets, and so on until the simák rises, which is the last mansion of the northern set, and which alternates with the hút (fish): the one sets when the other rises the second morning. Rising and setting are not to be taken in the usual meaning, or rising from the horizon; for in this sense, the mansions of the moon rise and set every twenty-four hours. The meaning is this. When the sun approaches to a fixed star or planet, he hides it and it is not visible to the eye of the observer; a star is therefore visible only at night and not at day time, and being in occultation is as much as being not on the sky. The star remains invisible until it is sufficiently distant from the sun; it can first be seen at dawn, for the light of the sun (not of the stars as the MSS. has it) is then weak and does not overpower the light of the stars; the star of the rising mansion can therefore be seen in the east in the morning. This is the meaning of the term "the rise of a mansion." Its watch-

man becomes at the same time invisible, and this is the meaning of the term "it sets." Fourteen mansions are constantly visible in the hemisphere of the heaven which is above the earth, the other fourteen mansions are concealed under the earth, in the other half of the heaven. To every two and one third mansion corresponds our sign of the zodiac. The mansions of the sharaṭán, boṭayu and one third of the thorayyá correspond to Aries, &c.

و هذه المنازل بعضها رقيب لبعض و معنى الرقيب هو الذي يعرف به طلوع الاخر كانه يراقب بالطلوع غروب صاحبه و السبب في ذلک هو ان المنازل تنقسم قسمين كما قد منا قسم يماني وهو اربعة عشر منزلة و قسم شامي و عدده ذلک فاذا طلعت المنزلة الاولى من القسم اليماني غربت المنزلة الاولى من القسم الشامي و اول القسم الشامی الشرطان و اول القسم اليني الغفر فاذا طلعت منزلة الشرطين غابت منزلة الغفر و هكذا الحال الى ان تطلع منزلة السماک وهي اخر منازل القسم الشامي و يغيب منزلة الحوت و غروبها طلوعها مع الفجر الثاني و غروبها مع طلوعه لا طلوعها من الافق و غروبها فيه فان ذلک موجود لها كل يوم و ليلة و لكن المراد به ان الشمس اذا قربت من كوكب من الكواكب الثابتة و المتحركة سترته و اخفته عن عيون الناظرين فصار يظهر نهارا و يخفى ليلا فكان خفاوه غيبة له و لا يزال كذلک خافيا الى ان تغيب عنه الشمس بُعداً يمكن فيه ان يظهر للابصار و ذلک عند اول طلوع الفجر فان ضوء الكواكب يكون ضعيفا حينئذ لا يغلب نور الكواكب و فيرى الكوكب فی الافق الشرقي ظاهراً و ذلک عبارة عن طلوعه و يخفى في ذلک الوقت رقيبه و هو عبارة عن غروبه فلايزال اربع عشرة منزلة خافية تحت الارض ابداً في نصف الفلک و لكل منزلتين و ثلث برج من البروج الاثني عشر فالشرطان و البطين و ثلث الثريا للحمل و كذا الى اخر المنازل •

It seems that the mansions of the moon must be considered as a division of the ecliptic by which the progress of the sun through the vastness of the heavens is measured, and the time of its annual revolution divided into twenty-eight parts or solar months. The motion of the moon has furnished this division. From the observation of the same stars from which the Arabs learned what solar month of the year was, they could also learn the date of the lunar month and even the hour of the night. The lunar mansions were the almanac and dial of the illiterate children of the desert, and they are probably their own invention. As a more precise knowledge of them may be of historical interest, I insert here another passage of Wa*t*wá*t* (Lib. I. cap. 3) on the subject:—

"As the Arabs (Bedouins) had no knowledge of the results which the ancients had obtained by their observations of the fixed stars, and as they were not acquainted with the stars which might enable them to define the seasons of the year and to fix the time, they observed certain stars and attempted to ascertain by experience to what extent the heliacal setting of every star was true or deceptive (in predicting the weather), and what influence the stars exercise on the temperament and constitution of man when they rise or set. They did not however attend to the signs of the zodiac in their observations, but they divided the sphere of the fixed stars into a number of parts, equal to the number of days of a revolution of the moon, that is to say into twenty-eight. They looked for a sign to mark the distance which the moon passes in twenty-four hours; and called it "stage" (mansion). They began with the two stars in the horn of Aries, called shara*t*án, then they looked out for another star by which to might mark the distance which the moon goes in 24 hours, starting from the shara*t*án, and this star is bo*t*ayn. After the bo*t*ayn comes the tharayyá, &c. It is the Arabs who gave names to these stars without reference to the division or signs of the Zodiac, thus the haq'ah is one of the stars marking the limit of a mansion of the moon, yet it is not in the Zodiac but in Orion. The term mansion is taken by exact writers in the meaning of a portion of the heavenly sphere equal to one-fourth of one-seventh, i. e. one twenty-eighth of the circumference. It is not more than this, for the moon, in her mean course arrives on the 29th day at the spot from which she started. Mansion means originally the respective arc and not

the star, for the stars are only the limits which divide one mansion from another, but these were called after the stars, and now the names of the stars are applied to the respective mansions. Every mansion has $13\frac{1}{112}$ days, for this is the result if you divide $365\frac{1}{4}$, the number of days of the solar year by 28. The almanack of the mansions is calculated by the solar year, for their apparition (read ظهورها instead of طورها) is connected with the solar year. Every mansion has therefore thirteen days or degrees. But the solar year is one day and one fourth of a day longer than this period (i. e. 28×13 days), therefore one day is added to the last mansion, which is called jabhat. To make up for the remaining fourth, a day is intercalated every four years in the mansion of the jabhah. The sharatán are considered the first mansion, for they are in Aries, which is the first sign of the Zodiac."

و لمالم يصل الى العرب ما حققه القدماء برصدهم من الكواكب الثابتة وكان لاغنى لهم عن معرفة كواكب ترشدهم الى العلم بفصول السنة و ازمنتها رصدوا كواكب و امتحنوا كلا منها بما يصدر عنه من صوادق الانواء و كواذيها وما يحدث من التاثيرات في طبعهم وقامتهم بطوالعها و غواريها و لم يستعملوها صور البروج على حقيقتها لانهم قسموا الفلك المكوكب على مقدار الايام التي يقطعه القمر فيها وهي ثمانية وعشرون يوما وطلبوا في كل قسم منها علامة يكون العباد ما بينها في راى العين مقدار مسير القمر في يوم و ليلة وسموها منزلة وبدءت بالشرطين ثم طلبوا بعد الشرطين علامة اخرى تتضمن بعد اليوم والليلة فوجدت البطين وبعد البطين الثريا وكذلك ساير الاسماء وهم الذين وضعوا هذه الاسماء عليها ولم تلتفت الى البروج واقسامها ومقادير صورها لانهم ادخلوا الهقعة في جملة المنازل وليست فى البروج وانما هي فى الصور

و المنزلة عند المحققين قطعة من الفلك مقدارها ربع سبع الدور وهو جزء من ثمانيه وعشرين جزءاً من الفلك وانما لم تكن اكثر من هذا القدر لان القمر اذا سار سيره الوسط انتهي فى اليوم التاسع و العشرين الى الموضع الذي بدا منه فحذف المكرر فيبقى ثمانية

و عشرون يوما فجعلت المنازل على عدد الايام و المنزلة عبارة عن العصا لا عن الكوكب و انما الكوا كب حدود تفرق بين كل منزلة و اخرى فعدل بالتسمية اليها و غلبت عليها و لكل منزلة من الايام ثلاثة عشر يوما و ربع سبع يوما و نصف ثمن سبع يوم على التقريب و سبب ذلک انک اذا قسمت السنة الشمسية التي هي ثلثمايه و خمس و سبون يوما و ربع يوم بالتقريب على ثمان و عشرين خص كل منزلة ما ذكر من العدد و الكسور و انما اضيف العمل بها الى الستة الشمسية لان طورها و اختفاء ها يكون بالذسبه الى الشمس و لما كان الامر كذلک جعل لكل منزلة ثلاثة عشر يوما التي هي ثلات عشرة درجة من درج الفلک و جميع ما فضل من الكسور على كل ثلاثة عشر يوما بعد انقضاء ايام المنازل الثمانية و العشرين فكان يوما و ربعا فجعل يوما فى المنزلة التي توافق اخر السنة و هى الجبهة و بقى ربع يوم فسى اربع سنين حتي صار يوما فزيد على الجبهه للعلة المذكورة و انما جعل ابتداء المنازل الشرطين لانها فى الحمل و الحمل اول ما عُدَّ من البروج و قد ذكرنا السبب الذي من اجله عدَّ الحمل اولاً *

In the following account of every mansion of the moon I follow the same author, but abridge his text:—

"Fourteen mansions are northern and called the left mansions, and as many are southern and called the right. When the northern mansions rise (heliacally) the night is longer than the day, and when the southern ones rise the day is longer than the night. The moon either makes her daily stages in the respective mansion or a little before or behind it (but in the same line), or out of the line of the mansions to the north or south.

1. *Sharatán* or shar*t*án (dual), sing. shar*t* or shara*t*, pl. ashrá*t*, which means signs علامات. Also called the horn (نطح I would observe that this and most other pure Arabic terms of returning are obsolete in their common acceptation, or perhaps belong to a dialect, which forms but a slight ingredient into the written language) being, according to those

who paint the constellations, in the horns of Aries. The sharatán are two bright stars, not far asunder north and south; not far from the southern is another and smaller star, which is sometimes added to the preceding two. The setting of the sharatán portends luck. The Arabs say

اذا طلع (sic) الشرطان اعتدل الزمان وتخضرت الاوطان وتوافقت الاسنان وتهادت الجيران وبات الفقير بكل مكان

"When the sharatán rise (set?), day and night are equal, the country becomes green, the teeth stand opposite each other (?), neighbours make presents to each other, and the poor man may spend the night wherever he likes."

2. Botayn (the small belly) the diminutive is used because there is a star in the fish called belly (batn). Three stars resembling a horse-shoe, somewhat less in magnitude than the sharatán. Those who make drawings of the constellations place them in the belly of Aries.

3. Thorayyá (Pleiades); six small stars; ignorant people believe that there are seven, they are close together and look like sparks. Some say there are twelve, but it would require the eye of Muhammed to see them. This constellation is called al-najm (the star) in the same manner as Venus is called al-kawkab (the star) *par excellence.* The Pleiades are also called the fat sheep's tail الية الحمل; most times the moon does not go into the Pleaides but into Lhyqah الضيقة (straits) which is the name of two small stars between the Pleiades and Aldabaran. This is considered as the best and most lucky nawö by the Arabs, and occurs therefore frequently in their poetry. (The rhymes of the Bedouins on this and some other mansions are so much disfigured by errors that they could not be transcribed here).

4. Dabarán is a bright red star, before it (east of it) is a group of many stars, of which two stars are nearer to dabarán than the rest. These are called the two dogs كلبان of the dabarán; and the rest its booty غنيمة (غنايم its flock of sheep?) or its camels قلاص. The two Bedouin proverbs: "more faithful than dabarán اوفي من الجاري يعنون الدبران)," and "more treacherous than the Pleiades (اغدر من الثريا)" are owing to the constancy with which the latter follow the former, who is his faithless love. The dabarán is also called تالي النجم and تابع النجم and حادي النجم and المجدح and عين الثور and الفنيق. It is of the first magnitude.

5. Haq'ah (race-course, دايرة تكون لسبق الغرس) three small nebular stars called the jalha (fire-place of three stones disposed like a horse-shoe).

6. Han'ah (curved), five stars resembling a club with a hook at the top called صولجة. Three form a straight line. The third is called the bow of the Gemini قوس الجوزا, the fifth is turned back (forms the hook) by about one space towards the south. Astronomers place the han'ah in the foot of the gemini; some call it the bow of the gemini, with which they shoot at the arm of the lion, and give to it eight stars which have the shape of a bow, and of which the two stars which form the han'ah in its more limited sense, form the place where it is held. Others say the han'ah consists of two stars which are very close to each other, and the northern of which is brighter and called the pearl, در and the southern is called الميسان. Sometimes the moon takes up her quarters in three stars called النجاتي, which are opposite the han'ah. Here the moon crosses the northern galaxy.

7. Dzirá' (arm), two stars, one bright the other dark, distant from each other the length of a horse-whip. There are several small stars between them called the nails الاظفار. This is the southern of the two arms of a lion and also called مقبوضة (shut), the other arm is called مبسوطة (expand), they are like each other. Astronomers place the latter in the canis minor. The Bedouins say

اذا طلع الذراع حسرت الشمس القناع واشعلت في الارض الشعاع وترقرق السراب بكل قاع و كنت الظباء و السباع

"When the dzirá' rises the sun takes off her veil, the coal is lighted on earth, everywhere shines the mirage, and the gazelles and lions go into their dens."

8. Nathrah is a nebula resembling a portion of a cloud. Astronomers place it into the hut of the crab. This star is called nathrah (bridge of the nose), because on either side there are two small stars called the nostrils of the lion, and before them is his forehead جبهة. Some however say that this mansion is mouth of the lion فم الاسد some call it the اللهاة.

9. Tarf (the eye of the lion), two small stars close to each other, before them are six small stars called by the Bedouins اسفار (traveller; this is probably an error instead of اشفار eye-lashes); two of these stars

stand symetrically with the eyes, the other are before them. The Arabs make nearly as much of this mansion as they make of the Pleiades.

10. Jabhah (the forehead of the lion), three bright stars, the middling one is farthest to the east, they form therefore a triangle with long sides and a short base. South of them is a bright very red star called the heart of the lion قلب الاسد. The astronomers place this mansion in the shoulder of Leo. The nawö of this mansion causes high winds.

11. Zobrah, also called الزبرتان and الحراثان and عرف الاسد, two bright stars two cubits asunder east and west, extending along the equator. They are called haráthán (incisions in the bow to receive the string) because they look like holes in the heaven. Below these two stars are nine lesser ones called hair شعر. These eleven stars together are compared with the mane on the back of the lion and called zobrah. The Arabs say اذا طلع الحراثان اكلت أم حردان—"when the haráthan rise the small dates of the Hijáz are eaten."

12. Cirfah, a bright star, it is considered to be the قنب of the lion, which is explained to وعا القضيب; close and almost connected with this star are seven very small stars. This mansion is called cirfah, for when it rises with the dawn (in March) the heat returns, and when it sets, the cold; it is therefore said to be the gate of time. Astronomers place it on the tail of Leo.

13. 'Awwâ five bright stars having the figure of ل from north to south; four of them are in a line and one turn up. This mansion is also called the buttocks of the lion وركي الاسد. The Bedouins also likened it to a dog who goes behind the lion. Astronomers place it in the breast of Virgo.

14. The unarmed simák (Spica virginis) is a bright bluish star. On its side is another bright star called the simák, with a spear (Arcturus), for it has a small star in front considered to be its spear. Both simáks are of the first magnitude. The unarmed simák is towards the south of the armed, سماك الرامح. The name simák (a thing with which another thing is raised) has been given to these two stars, because they are near the zenith. The astronomers place the simák in the Spica, عذرا; some times the moon takes up his mansion in four stars in front of the unarmed simák, called عجزا الاسد, (buttocks of the lion) or عرش السماك (seat of

the simák). This mansion is between the southern and northern mansions.

15. Ghafr—three very small stars on a curved line; astronomers place them between the thighs of Leo. Prophets are born at the nawö of this mansion, which takes place in April.

16. Zobániyán—two bright stars; astronomers place them in the scales of Libra. They are the length of a man asunder. The Arabs say: اذا طلع ازباني احدث الدهر لكل ذي عيان شانا ولكل ذي ماشية هوانا.

"When the zobány rises, time assumes a new shape for every one that has eyes, and easy for every animal."

17. Iklyl (crown), three stars about one cubit asunder, behind the ghafr. They are like a crown upon Scorpio. They are with astronomers on the beam of Libra. The Arabs say: اذا طلع الاكليل هاجت الفحول و شمرت الذيول تخوفت السيول. "When the crown rises on male animals in heat and rivers dry up."

18. Qalb—a red bright twinkling star, near two small stars, called نياتي القلب (the vein and artery which issue from the heart) by the Bedouins. Astronomers place this star in the heart of the Scorpion. There are four constellations which are called heart قلب, first the heart of the scorpion, simply called the heart, which has just been mentioned; second قلب السمكة, third قلب الثور, fourth قلب الاسد.

19. Shawlah; several stars in a curved line resembling the raised tail of a Scorpion, among these are two small stars close together like a double star; one of them is called by the Bedouins ابرة and the other حمه; close behind them is another star called تابع. Some people say the moon does not enter the shawlah but remains before it. Sometimes she takes up her mansions in the فقار, which is between the qalb and shawlah, and consists of six white stars in a curved line.

20. Na'áyim—eight stars, the four southern of them are bright, and form an irregular square, and are called واردة, this is the station of the moon. Wáridah means sheep; or cattle going to drink water, and this name has been given to these stars because they are close to the milky-way, which is likened to a river. The other four stars are called النعام الصادرة (i. e. returned from drinking water), because they are some distance from the milkyway. Astronomers place the wáridah in the hand of Sagittarius, with which he pulls the bow.

21. Baldah—a round fissure in the heaven without a star. Baldah means in the Bedouin dialect a fissure in the ground, فرجة من الارض. This fissure is surrounded by six small stars resembling a bow; some people call them. أدحي (ostrich's nest), for not far from it are other stars called بيض (eggs) by the Bedouins. The moon sometimes makes her stage in the od*h*á. Astronomers place the baldah in the forehead of Sagittarius.

22. So'úd, (luck,) so called because they bring rain. There are four sa'd: 1st.—Sa'd dzábih—two small stars less than a cubit asunder north and south. Astronomers place it into the horn of Capricorn.

23. 2d. Sa'd bola'—two stars as far asunder as the above mentioned. Astronomers place it in the heel of Aquarius. The epithet devouring is given to this constellation, because at its nawö the rivers and wells being full the earth devours its own water.

24. 3d. Sa'd al-so'úd (luck of lucks). According to some, two stars, as the above, and according to others three, one is bright, the others smaller. Astronomers represent them in the breast of Aquarius. Sometimes the moon makes her stage in the السعد الناشرة; the Bedouins say: اذا طلع سعد السعود ذاب كل جلمود و اخضر كل عود وانتشر كل مصرود ودفي كل مبروه "When the sa'd al-so'úd rises, all which is frozen melts, and trees and shrubs come to life again."

25. 4th.—Sa'd al-akhbiyah. Some are of opinion that this mansion is marked by one star which is surrounded by three others. The latter form a triangle, and are the tent خبا, of the former star, which is considered to be the sa'd. Others considered the central star as the *pole* of the tent. Astronomers place this mansion on the eastern shoulder of Aquarius.

26. Farazh al-moqaddam, also called farazh al-awwal and farazh al-a'lá—two bright stars apparently about five cubits asunder. Astronomers place it into the northern hip of the horse.

27. Farazh al-mowäkhkhar, also called the second or lower (i. e. southern) farazh or dalw. Two stars resembling the preceding; one is north and the other is south. Astronomers place them in the hind quarter of the horse. The moon sometimes stops short and takes up her mansion in the middle of the عرقوي, and sometimes in the بلدة الثعلب.

28. *Hút*, الحوت, also called رشا—consists of eighteen small stars which have the shape of a fish, whose head is towards the north and the tail towards the south. To the east of this is a star of the first magnitude.

called the navel, سرة, or heart, قلب, or belly بطن of the fish السمكة, or الحوت; sometimes the moon takes up her mansion in the lesser fish, which is farther to the north of the greater fish. These two constellations resemble each other, but the lesser fish is broader and shorter than the greater. Another (the star) of them rises at the same time in the east. Nawö, means rising with a weight; some say that nawö means also setting, and that this is one of those words which have opposite meanings. The sun is in every one of the mansions of the moon 13 days, and after he has passed through them he returns into the first. If a change of weather takes place when one of these stars sets and another rises, the Arabs ascribe it to the star thorayyá, dabrán, haq'ah, han'ah or dzirá'. Summer is called qaytz by the Bedouins and çayf by towns-people, it begins when the sun enters into the Crab. The stars of the mansions of the moon are—nathrah, *t*arf, jabhah, zobrah, çarfah, 'awwá and simák.

The meaning of nawö (*plur.* anwá) is that one of these twenty-eight stars sets in the west in the morning.

Notes on the Nidification of Indian Birds. By *Captain* Thomas Hutton, F. G. S.

(Continued from No. 193, for July 1848.)

No. 21.—"*Psilorhinus occipitalis.*" (Blyth, J. A. S. XV, 27).
"*Pica erythrorhyncha.*" (Gould's Century.)
"*Psilorhinus albicapillus.*" (Blyth, nestling plumage.)

This species occurs at Mussooree throughout the year, collecting into small parties of 4 to 6 during winter. It breeds at an elevation of 5,000 feet in May and June, making a loose nest of twigs externally, lined with roots.

The eggs are from 3 to 5, of a dull greenish ash-grey, blotched and speckled with brown dashes, confluent at the larger end. Diameter $1\frac{4}{16} \times \frac{14}{16}$ inches. The ends nearly equal in size. The nest is built on trees, sometimes high up; at others about 8 or 10 feet from the ground.

The "*Psilorhinus albicapillus*" of Mr. Blyth, is nothing more than the nestling of this species, as I have fully ascertained this season by

robbing several nests,—the plumage of the young birds agreeing exactly with his published description.

No. 22.—"*Dendrocitta sinensis.*" (Gray.)
Crypsirina sinensis. (Hodg. Gray.)
Pica sinensis. (Gray.)
Corvus sinensis. (Daud.)

Occurs abundantly about 5,000 feet during summer; more sparingly at greater elevations,—and in the winter it leaves the mountains for the Doon. It breeds in May, on the 27th of which month I took one nest with 3 eggs and another with 3 young ones. The nest is like that of *Psilorhinus occipitalis,* being composed externally of twigs and lined with finer materials, according to the situation,—one nest taken in a deep glen by the side of a stream was lined with the long fibrous leaves of "*mare's tail*" which grew abundantly by the water's edge; another taken much higher on the hill side and away from the water, was lined with tendrils and fine roots. The nest is placed rather low, generally about 8 or 10 feet from the ground, sometimes at the extremity of a horizontal branch, sometimes in the forks of young bushy oaks. The eggs somewhat resemble those of the foregoing species, but are paler and less spotted, being of a dull greenish ash, with brown blotches and spots somewhat thickly clustered at the larger end. Diameter $1\frac{2}{16} \times \frac{12}{16}$ inches. Shape ordinary.

No. 23.—"*Geocichla citrina.*" (Blyth.)
Petrocossyphus citrinus. (Gray's Cat.)
Turdus citrinus. (Lath.)
P. pelodes. (Hodg.) young.

Arrives at an elevation of 5,000 feet about the end of May and returns to the plains in autumn; it breeds in June, placing the nest in the forky branches of lofty trees, such as oaks and wild cherry; externally it is sometimes composed of coarse dry grasses somewhat neatly interwoven on the sides,—but hanging down in long straggling ends from the bottom. Within this is a layer of green moss and another of fine dry woody stalks of small plants and a scanty lining at the bottom of fine roots. The eggs are 3 to 4 in number, pale greenish freckled

with rufous; the spots of that colour confluent and forming a patch at the larger end. Diameter $1\frac{1}{16} \times \frac{12}{16}$ inches. Somewhat gibbous at the larger end.

No. 24.—"*Geocichla unicolor.*"

Turdus unicolor. (Tickell & Gould.)

Petrocincla homochroa. (Hodg. Gray.)

Petrocossyphus unicolor. (Gray's Cat.)

This bird arrives in the hills up to 7,000 feet, and probably higher, about the end of March, the first being heard this year (1848), on the 26th of that month, at 5,000 feet. Every morning and evening it may be heard far and near, pouring forth a short but pleasing song from the very summits of the forest trees. It is a summer visitor only, returning to the plains in early autumn. It breeds in May and June, laying 3 or 4 eggs of a dull greenish white, freckled, blotched and spotted with rufous, sometimes closely,—sometimes widely distributed.

The nest is neatly made of green moss and roots, lined with finer roots, and placed usually against the body of the tree, from whence spring one or two twigs;—sometimes placed upon the broad surface of a thick horizontal branch, or on a projecting knob. The diameter of egg—$1\frac{1}{16} \times \frac{13}{16}$ inches, varying a little. Shape sometimes ordinary ovate; at others more rounded at the smaller end. When shot, the crop usually contained the half-ripe berries of a species of laurel (*L. lanceolatus ?)*

The following is the description of a male, shot while singing on the topmost branch of an oak tree (*Quercus incana.)*

Bill yellow, as also the rim of the eyelid, gape, inside of mouth and the legs.—Iris brown.—Length 9 inches. Wing from bend $4\frac{3}{4}$ inches. Above uniform pale slate-grey;—throat, breast, and sides ash colour, the former palest and nearly white on the chin. Belly and under tail coverts pure white; under wing coverts bright ferruginous. Nails yellow, length of bill to gape $1\frac{2}{16}$ inches. Tarse $1\frac{1}{16}$ inches.

Female. Bill wax-yellow with dusky about the nostrils; legs and feet wax-yellow; Iris brown; length 9 inches;—wing from bend $4\frac{7}{8}$ inches; bill to gape $1\frac{1}{16}$ inches—to forehead $\frac{7}{8}$ inches. Above uniform dark ashy-gray; chin and throat pale cinereous, bordered by a dark stripe descending from the base of lower mandible, between which the feathers are longitudinally dashed with dark centres; breast and

sides ashy tinged with fulvous; belly, vent and lower tail-coverts white; under-wing coverts bright ferruginous; ear-coverts ashy with pale shafts.*

The nestling is above like the female, but beneath the throat and chin are purer white in some;—in others with a rufous tinge, but no spots between the stripes descending from the base of lower mandible, and the breast much spotted with brown;—scapularies and greater wing-coverts tipped with triangular fulvous spots ascending through the shafts of the feathers. This during the summer months is one of the commonest birds in the hills, especially about 5,000 feet, where their nests are numerous.

No. 25.—"*Myophonus Temminckii.*" (Vigors. Gould.)
M. metallicus. (Hodg.)

On the 16th June, I took two nests of this bird, each containing 3 eggs,—and another one containing three nearly fledged young ones. The nest bears a strong resemblance to that of the *Geocichlæ* above noticed, but is much more solid, being composed of a thick bed of green moss externally, lined first with long black fibrous lichens, and then with fine roots. Externally the nest is $3\frac{1}{2}$ inches deep, but within only $2\frac{1}{2}$ inches; the diameter about $4\frac{3}{4}$ inches, and the thickness of the outer or exposed side is 2 ins.

The eggs are 3 in number, of a greenish ashy, freckled with minute roseate specks, which become confluent and form a patch at the larger end; shape ordinarily, and rather gracefully, ovate; diameter $1\frac{6}{16} \times \frac{15}{16}$ in.

The elevation at which the nests were found was from 4,000 to 4,500 ft., but the bird is common, except during the breeding season, at all elevations up to the snows, and in the winter it extends its range down into the Doon. In the breeding season it is found chiefly in the glens, in the retired depths of which it constructs its nest;—it never, like the Thrushes and Geocichlæ, builds in trees or bushes, but selects some high towering and almost inaccessible rock forming the side of a deep glen, on the projecting ledges of which, or in the holes from which small boulders have fallen; it constructs its nest, and where, unless when assailed by man, it rears its young in safety, secure alike from the howling blast and the attacks of wild animals. It is known to the natives by the name of "*Kuljet,*" and to Europeans as the "*Hill Black bird.*"

* The female of this race is utterly undistinguishable from that of *G. dissimilis*, nobis, J. A. S., XVI, 144.—E. B.

The situation in which the nest is placed is quite unlike that of any other of our Hill Thrushes with which I am acquainted, and the habits of the bird render it far more deserving of the name of *Petrocossyphus* or "*Rock blackbird*," than those to which, in the Catalogue of Mr. Hodgson's Collection, Mr. Gray has assigned that name. Indeed, as applied to the two preceding species, it is altogether a *misnomer*, for they are, in the first place,—not *Blackbirds* or *Merulæ*, as the Greek word "*Cossyphus*" implies,—and in the second place, they are not *Rock* lovers at all, but true forest birds, building in trees and taking their food upon the ground, where they find it in berries and insects among the withered leaves which they expertly turn over with their beaks, and hence the reason why the beak is almost invariably clotted with mud or other dirt. I have never seen these Geocichlæ *except in woods*,—whereas "*Myophonus Temminckii*" is as often found in open rocky spots on the skirts of the forest, as among the woods, loving to jump upon some stone or rocky pinnacle, from whence he sends forth a sort of choking chattering song, if such it can be called,—or with an up jerk of the tail, hops away with a loud musical whistle, very much after the manner of the British Blackbird (*M. vulgaris*).* On the southern side of the range at Jerrepanee, elevation about 5,000 ft. the forest is open and scattered among immense bare blocks of stone;—on the northern side of the same range, the forest is dense and contains much underwood. It is remarkable that while the Geocichlæ above noticed, are strictly confined to the close forest tracts of the northern side,—*Petrocossyphus cinclorhynchus* (Gray's Cat.) affects the rocky southern forest; I have however occasionally seen the latter on the northern side also, but I cannot call to mind a single instance in which I have seen either *Geocichla citrina* or *G. unicolor* on the southern side. This fact will at once show how little applicable to the latter birds is Mr. Gray's name of *Petrocossyphus*. Mr. Gray may possibly reply to my criticism by asking—"*what's in a name?*" To which I must respond that in natural history, as with man, *a good name* is most important, and *ought* as much as possible to convey some idea of habits,

* The sweet songster to which Mr. Vigne alludes, as being heard by him, was not this bird, whose song, if such it can be called, is nothing but a subdued grating chatter, as if singing to itself; the song heard by Mr. Vigne was that of *Merula boulboul*, by far the sweetest songster in the Hills.

manners, or markings, so as to assist the naturalist not only in the identification of species, but also lead him to the places where he might expect to find them. But who would ever dream of seeking in the forest's gloom for birds whose name pointed to the fact of their delighting in rocky situations? Yet, if misled by the generic name *Petrocossyphus*, the naturalist should venture to some rock-bestudded mountain in search of the species "*citrinus*" and "*unicolor*"—he would have nothing but his trouble as his reward, for those species are procurable only amidst the boughs and thickets of the forest.

No. 26.—"*Copsychus saularis*," (L.)
Gryllivora intermedia, Swainson.
Dahila docilis, Hodgson.

Arrives on the hills up to 5,000 ft. and perhaps higher, in the beginning of April. It returns to the Doon and plains in early autumn. It breeds in May, on the 19th of which month I took a nest from a bank by the road side; it was composed of green mosses and lined with very fine roots. Eggs 4; carneous cream colour. Somewhat blistered at the larger end. Diameter $\frac{12}{16} \times \frac{8}{16}$ ins.

This species delights to sit on the topmost branches of a tree, generally selecting some dry and leafless branch, from whence it utters a pleasing song, which is replied to by another individual at no great distance; when on the ground it hops with the wings half open or drooping, and at each hop it stops to spread and flirt the tail.

No. 27.—"*Stoparola melanops*." (Blyth.)
Niltava? melanops. (Gray's Cat.)
Muscicapa melanops. (Vigors. Gould.)

This is a common species throughout the mountains up to about 12,000 ft. during summer, arriving about the beginning of March. It breeds in May and June, making a neat nest of green moss in holes of trees, in stumps, and in the holes of banks by the road side. The eggs are 3 to 4 in number, dull white with faint rufous specks at the larger end and somewhat inclined to form a ring.

The bird has a pleasing song. Gould figures this species very faultily,—as the *black* of the lores *does not* pass beyond the eye, as he represents it, and the under tail coverts instead of being uniform pale greenish, are dull blue green, each feather apically barred with dull white. In the winter it leaves Mussooree.

No. 28.—"*Cyornis rubeculoides.*" (Blyth.)
Niltava rubeculoides. (Hodg.)
Phœnicura rubeculoides. (Vigors.)
Chaitaris brevipes. (Hodg.)

Arrives in the neighbourhood of Mussooree in April, and breeds in June, on the 13th of which month I took a nest from a hole in a bank by the road side in a retired and unfrequented situation: I afterwards found another nest in a hole of a rock, also in a retired spot. The elevation was about 5,000 ft. Externally the nest is composed of green moss, and lined with black fibrous lichens like hair. The eggs are 4 in number, of a dull and pale olive green, faintly or indistinctly clouded with dull rufous or clay colour. Diameter $\frac{12}{16} \times \frac{9}{16}$ ins. The male has a very pleasing song which he warbles forth from the midst of some thick bush, seldom exposing itself to view, like *Stoparola melanops*, which delights to perch upon some high exposed twig.

No. 29.—*Sibia capistrata.* (Hodg.)*

Remains at an elevation of 7,000 ft. throughout the year, but I never saw it under 6,500 ft.;—its loud ringing note of *tittéreé—tittéreé twééyó*, quickly repeated, may constantly be heard on wooded banks during summer. It breeds at Mussooree in May, making a neat nest of coarse dry grasses as a foundation, covered laterally with green moss and wool, and lined with fine roots. The number of eggs I did not ascertain, as the nest was destroyed when only one had been deposited, but the colour is pale bluish white freckled with rufous. The nest was placed on a branch of a plum tree in the botanical garden at Mussooree.

No. 30.—"*Dicrurus longicaudatus.*" (A. Hay.)

This species, the only one that visits Mussooree, arrives from the Doon about the middle of March and retires again about September. It is abundant during the summer months, and breeds from the latter end of April till the middle of June, making a very neat nest, which is placed in the bifurcation of a horizontal branch of some tall tree, usually oak trees; it is constructed of grey lichens gathered from the trees, and fine seed-stalks of grasses, firmly and neatly interwoven; with the latter it is also usually lined, although sometimes a black fibrous lichen is used;—externally the materials are kept compactly together, by being plastered over with spiders' webs. It it altogether a light and elegant

* *Cinclosoma capistratum*, Vigors, v. *Sibia nigriceps*, Hodgson.—E. B.

nest. The shape is circular, somewhat shallow and diameter within 3 inches. The eggs are 3 to 4,—generally the latter number, and so variable in colour and distribution of spots, that until I had shot several specimens and compared them narrowly, I was inclined to think we had more than one species of *Dicrurus* here. I am however now fully convinced that these variable eggs belong to the same species. Sometimes they are dull white with brick red spots openly disposed in form of a rude ring at the larger end; at other times the spots are rufescent claret with duller indistinct ones appearing through the shell;—others are of a deep carneous hue, clouded and coarsely blotched with deep rufescent claret; while again some are faint carneous with large irregular blotches of rufous clay with duller ones beneath the shell. Diameter varying from 1 × $\frac{14}{16}$;—to $\frac{14}{16}$ × $\frac{11}{16}$ ins.

No. 31.—"*Campephaga fimbriata.*" (Temm.)
Campephaga lugubris. (Gray's Cat.)
Ceblephyris lugubris. (Sundevall.)
Volvocivora melaschistos. (Hodg. Gray.)
Graucalus maculosus. (McClelland.)

This too is a mere summer visitor in the hills, arriving up to 7,000 ft. about the end of March, and breeding early in May. The nest is small and shallow, placed as in the last in the bifurcation of a horizontal bough of some tall oak tree, and always high up; it is composed externally almost entirely of grey lichens picked from the tree, and lined with bits of very fine roots or thin stalks of leaves. Seen from beneath the tree, the nest appears like a bunch of moss or lichens, and the smallness and frailty would lead one to suppose it incapable of holding two young birds of such size. Externally the nest is compactly held together by being thickly plastered over with cobwebs. The eggs are two in number, of a dull grey green closely and in parts confluently dashed with streaks of dusky brown. Diameter $\frac{13}{16}$ × $\frac{11}{16}$ ins.

The bird has a plaintive note which it repeatedly utters while searching through a tree, after the manner of *Collurio Hardwickii*, for insects.

No. 32.—"*Abrornis schisticeps.* (Hodg.)
Culicipeta schisticeps, (Gray's Cat.)
Phyllopneuste xanthoschistos. (Hodg.)

A common species at 5,000 ft. and commences building in March. A pair of these birds selected a thick China rose bush trained against

the side of the house, and had completed the nest and laid one egg, when a rat destroyed it. I subsequently took two other nests in May, both placed on the ground in holes in the side of a bank by the road side. In form the nest is a ball with a ronnd lateral entrance and is composed externally of dried grasses and green moss, lined with bits of wool, cotton, feathers, thread and hair. In one I recognized more than one lock of my own child's hair, which had been cut not long before, and had been appropriated by the bird. The eggs are 3 in number and pure white. Diameter $\frac{10}{18} \times \frac{7}{16}$ ins.

No. 33.—"*Cryptolopha cinereocapilla.*" (Vieillot.)
Cryptolopha ceylonensis. (Strick.)
C. poiocephala. (Swain.)
Platyrhynchus ceylonensis. (Swain.)

I took a nest of this species on the 18th April in a deep and thickly wooded glen at an elevation of about 4,500 ft. It was placed against the moss-covered trunk of a large tree, growing by the side of a mountain stream, and was neatly and beautifully constructed of green moss fixed in the shape of a watch-pocket at the head of a bed, to the mosses of the tree, (with which it was completely blended,) by numerous threads of spiders' webs. The lining was of the finest grass stalks, no thicker than horsehair,—and beneath the body of the nest depended a long bunch of mosses fastened to the tree with spiders' webs, and serving as a support or cushion on which the nest rested securely. Within this beautifully constructed fabric were 4 small eggs of a dull white colour, with a faint olive tinge and minutely spotted with pale greenish brown, and having a broad and well defined ring of the same, near the larger end. The eggs were set hard. Diameter $\frac{9}{16} \times \frac{8}{16}$ ins. Shape bluntly ovate.

No. 34.—"*Parus erythrocephalus.*" (Vig.)

Common at Mussooree and in the hills generally throughout the year. It breeds in April and May. The situation chosen is various, as one taken in the former month at Mussooree, 7,000 ft., was placed on the side of a bank among overhanging coarse grass; while another taken in the latter month at 5,000 ft., was built among the same ivy twining round a tree, and at least 14 feet from the ground. It is in shape a round ball with a small lateral entrance, and is composed of green mosses warmly lined with feathers. The eggs are 5 in number,

white with pinkish tinge, and sparingly sprinkled with lilac spots or specks, and having a well defined lilac ring at the large end. Diameter $\frac{8}{16} \times \frac{6}{16}$ ins.

No. 35.—"*Parus xanthogenys.*" (Vig.)

Common in the hills throughout the year. It breeds in April, in which month a nest containing 4 partly fledged young ones was found at 5,000 ft.; it was constructed of moss, hair and feathers and placed at the bottom of a deep hole in a stump at the foot of an oak tree; the colour of the eggs was not ascertained.

No. 36.—"*Acrocephalus montanus.*" (Gray's Cat.)
Salicaria arundinacea? (Hodg. Gray.)

This species arrives in the hills up to 7,000 ft. at least, in April, when it is very common, and appears in pairs with something of the manner of *Phylloscopus*. The note is a sharp "*tchik-tchik,*" resembling the sound omitted by a flint and steel. It disappears by the end of May, in which month they breed, but owing to the high winds and strong weather experienced in that month in 1848, many nests were left incompleted, and the birds must have departed without breeding. One nest which I took on the 6th May, was a round ball with lateral entrance; placed in a thick barberry bush growing at the side of a deep and sheltered ditch; it was composed of coarse dry grasses externally and lined with finer grass. Eggs 3, and pearl white, with minute scattered specks of rufous, chiefly at the large end; diameter $\frac{10}{16} \times \frac{8}{16}$ ins. (The high winds which prevailed in May, destroyed an incredible number of the nests of various Doves, *Treron sphenura, Garrulus lanceolatus,* &c.)

No. 37.—"*Zosterops palpebrosus.*" (Temm.)
Z. annulosus. (Swain.)
Motacilla madagascariensis. (Gm.)
Sylvia madagascariensis. (Lin. Lath.)
Motacilla maderaspatana. (Lin.)
Sylvia palpebrosa. (Tem.)
S. leucops. (Vieillot.)
S. annulosa. (Swain.)
Zosterops maderaspatana. (Gray's Cat.)

These beautiful little birds are exceedingly common at about 5,000 ft. during summer, but I never saw them much higher. They arrive

from the plains about the middle of April, on the 17th of which month I saw a pair commence building in a thick bush of Hybiscus? and on the 27th of the same month the nest contained 3 small eggs, hard set. I subsequently took a second from a similar bush, and several from the drooping branches of oak trees, to the twigs of which they were fastened. It is not placed on a branch, but is suspended between two thin twigs, to which it is fastened by floss silk torn from the cocoons of "*Bombyx Huttoni*" (Westwood) and by a few slender fibres of the bark of trees or hair, according to circumstances. So slight and so fragile is the little oval cup, that it is astonishing the mere weight of the parent bird does not bring it to the ground; and yet within it three young ones will often safely outride a gale, that will bring the weightier nests of Jays and Thrushes to the ground.* Of seven nests now before me, four are composed externally of little bits of green moss, cotton, seed down, and the silk of the wild mulberry moth torn from the cocoons, with which last material moreover, the others appear to be bound together; within, the lining of two is of the long hairs of the Yák's tail *(Bison pöephagus)* two of which died on the estate where these nests were found; and the third is lined with black human hair; the other three are formed of somewhat different materials, two being externally composed of fine grass stalks, seed down and shreds of bark, so fine as to resemble tow; one is lined with seed down and black fibrous lichens resembling hair; another is lined with fine grass, and a third with a thick coating of pure white silky seed down. In all the seven, the materials of the two sides are wound round the twigs, between which they are suspended like a cradle, and the shape is an ovate cup about the size of half a hen's egg split longitudinally. The diameter and depth are respectively $2 \times \frac{3}{4}$; and $1\frac{1}{2}$ ins. The eggs usually 3 in number, of a very pale whitish green; diameter $\frac{8}{16} \times \frac{6}{16}$ ins. The young continue with the old birds for some time after leaving the nest, and are often mixed up with the flocks of *Parus erythrocephalus*. They appear to feed greedily upon the small black berries of a species of *Rhamnus* common in these localities. They depart for the Doon about the end of October.

No. 38.—"*Orthotomus longicauda.*" (Gm.)
O. Bennettii. (Sykes.)
O. suthorius, v. *ruficapillus*, v. *sphænura.* (Hodg. Gray.)

Motacilla longicauda. (Gm.)
M. sutoria. (Gm.)
Sylvia guzuratta. (Lath.)
O. lingoo. (Sykes) young.
O. sepium. (Skyes) young apud Blyth.
O. sphœnurus. (Swain.)
Sylvia ruficapilla. (Hutton.)

It is very evident from the accounts given both by Mr. Hodgson and Captain Tickell, of the colour of the eggs of supposed *O. longicauda,* that there must either be more than one species confounded under that name, or that they have erroneously attributed to it the eggs of some other species. In the J. A. S. No. 22, for Oct. 1833, I described the nest and eggs of true *O. longicauda,* under the name of *Sylvia ruficapilla,* and similar nests and eggs agreeing in every respect have since fallen under my observation ; in all of these the nest was composed of cotton, wool, vegetable fibre and horsehair, formed in the shape of a deep cup or purse enclosed between two long leaves, the edges of which were sewed to the sides of the nest in a manner to support it, by threads spun by the bird ;—the eggs are 3 to 4, of a white colour, sprinkled with small specks, chiefly at the larger end, of rufous or tawny. Captain Tickell gives the eggs "pale greenish blue, with irregular patches, especially towards the larger end, resembling dried stains of blood, and irregular broken lines scratched round, forming a zone near the large end." These cannot be the eggs of *O. longicauda,* any more than the "unspotted verditer blue eggs" mentioned by Mr. Hodgson, P. Z. S. 1845. p. 29.

The true *O. longicauda* occurs in the Doon along the southern base of the mountains, but does not ascend even in summer.

(Note.—I fear that in many instances Capt. Tickell has trusted solely to native information, in which case the chances are he has often been deceived ;—I have noted no nest that I did not either take myself, or examine before I allowed it to be touched.)

No. 39.—"*Drymoica criniger.*" (Hodg.)
Suya criniger. (Hodg.)

This little bird appears on the hills at about 5,000 ft. in May. A nest taken much lower down on 22nd June was composed of grasses neatly interwoven in the shape of an ovate ball, the smaller end upper-

most and forming the mouth or entrance; it was lined first with cottony seed down and then with fine grass stalks; it was suspended among high grass and contained 5 beautiful little eggs of a carneous white colour, thickly freckled with deep rufous, and with a darkish confluent ring of the same at the large end—Diameter $\frac{11}{16}\times\frac{8}{16}$ ins.—I have seen this species as high as 7,000 ft. in October. It delights to sit on the summit of tall grass or even of an oak, from whence it pours forth a loud and long continued grating note, like the filing of a saw.

No. 40.—"*Pyrgita indica.*" (Jard. Selb.)

This, if really distinct from the European Sparrow, does not appear to be a common bird on the heights,—nor is it nearly so common at 5,000 ft. as it is in the Doon; yet it cannot be called scarce. It breeds in the eaves of buildings and in bushes, making a loose slovenly nest of a round form with lateral entrance; it is of large size and constructed chiefly of dry grasses or hay externally, and plentifully lined with feathers, bits of cotton and wool. The eggs are pale ash colour, *moderately* sprinkled with specks and dashes of neutral tint, clustering rather thickly at the large end. Diameter $\frac{13}{16}\times\frac{9}{16}$ ins. Eggs usually about 6 in number. Breeds several times in the year.

No. 41.—"*Francolinus vulgaris.*" (Steph.)

This is a common bird in the Doon, and by no means rare in warm cultivated valleys far in the hills; it breeds in the hills in June; and a nest taken by a friend on whose accuracy I can rely, and who shot the old bird, contained 6 eggs of a dull greenish white colour; the egg appears very large for the size of the bird, and tapers very suddenly to the smaller end; diameter $1\frac{1}{2}\times 1\frac{3}{16}$ ins.

There is no preparation of a nest, the eggs being deposited on the bare ground. Called "*Kala-teetur*" by the natives.

No. 42. "*Euplocomus albocristatus.*" (Vigors.)

This species, the "*Kalich*" of the hill men, is found in the hills at all seasons, and is common at every elevation up to the snows. It breeds in May and June. In the latter month I found a nest, by the side of a small water course, composed merely of a few dead leaves and some dry grasses, which had very probably been accumulated by the wind and tempted the bird to deposit her eggs upon them. The spot was concealed by large overhanging ferns, and contained the shells of 8 eggs of a sullied or faint brownish-white like some hens' eggs; the tops of al

were neatly cut off as if by a knife, showing that the young ones had escaped, and singular enough I had the day before captured the whole brood, but knowing the almost impossibility of rearing them, had allowed them again to go free. The diameter of the egg is $2 \times 1\frac{6}{16}$ ins.

In Mr. Gray's Catalogue of the Collection presented to the British Museum by Mr. Hodgson, this and *Phasianus Hamiltonii* are given as synonymes of *Gallophasis leucomelanos*. In this there appears to be some degree of error, for the species are distinct. Mr. Blyth *in epistolâ*, writes that "there are" 4 true races and 2 hybrids. Of the former, one is *albocristatus;* crest rarely very white, the white on the rump always well developed, and found *exclusively* westward of Nipal. *Melanotus* (Blyth), has black crest, and no white on rump; common at Darjeeling; and the Nepalese *leucomelanos* is certainly a cross between these two. *Cuvieri* of Assam, Sylhet, &c. has white on rump, but underparts wholly shining black; and this has produced a mixed race with *lineatus* of Arracan."* If such be the case, the name of *leucomelanos*, belonging only to a hybrid, and not to a true species, must give place to Gould's name of *albocristatus*. *Phasianus Hamiltonii* of Gray's Ill. Ind. Zool. looks very like an immature male of the present species, but being from Nipal, is probably an immature hybrid. In the neighbourhood of Mussooree and Simla, we have only *Euplocomus (Gallophasis) albocristatus (verus)* the others all occurring more to the eastward, as correctly observed by Mr. Blyth. The long white crest is seldom or perhaps never found except in fully mature birds, it being generally of a dirty or dusky hue like that figured in Gould's Century; every place however is now so thoroughly poached over by native shikarrees, that an old white-crested bird is extremely rare.

No. 43.—"*Pucrasia macrolopha.*" (Gray's Cat.)
Phasianus pucrasse. (Gray. Griff. An. King.)
Gallophasis pucrasia. (Hodg. Gray.)

For the eggs of this species I am also indebted to a friend who took them in June from the ground, where there was no other symptom of a nest than a slight scratching away of the leaves and grass. The eggs were 5 in number, of a sandy brown, sprinkled over with specks, and

* Since the above was written, I have seen the series of specimens of these birds preserved in the Society's museum, and fully concur in Mr. Blyth's opinion.

large spots and blotches of deep red brown resembling dried blood. The diameter was $2\frac{1}{16} \times 1\frac{7}{16}$ ins. Shape ordinary, and altogether a very close miniature of the egg of *Lophophorus Impeyanus*. This bird occurs in the hills at all seasons, from Mussooree to the snows, and bears several names, such as "*Plass*" at Simla, "*Koklass*" at Mussooree, and "*Pocrass*" farther to the eastward.

No. 44.—"*Phasianus Wallichii.*"
Lophophorus Wallichii. (Hardw.)
Phasianus Stacei. (Vigors.)

This beautiful species is likewise truly a hill bird, being found at all seasons. Its egg is pure white and of the ordinary shape, but the number not ascertained. It is known as the "*Cheer,*" and "*Buncheel.*"

No. 45.—"*Lophophorus Impeyanus.*"
Phasianus Impeyanus. (Lath.)
L. refulgens. (Temm.)

These birds do not occur so low down as Mussooree, but are found in abundance on the next range; in days of yore they were found at Simla, but civilization has of late years banished them to the less disturbed localities. It makes no nest, but lays its eggs on the ground; the number not satisfactorily ascertained, as one nest contained 3 and another 4 eggs of a pale brown or sandy hue, thickly sprinkled over with reddish brown spots and dashes.

The diameter $2\frac{1}{2} \times 1\frac{13}{16}$ ins. Shape ordinary. Called "*Monaul.*"

No. 46.—"*Tragopan Hastingsii.*" (Vigors).

A pair of these birds kept in confinement produced 2 eggs in June, both of which were destroyed by the male; the colour was pale rufous brown like what are usually termed in this country (India) "game hen's eggs." These birds are only found on the loftier hills along the confines of the snow. They lived contentedly in confinement and became exceedingly tame. In the catalogue above referred to, Mr. Gray gives *Satyra melanocephala* of Hardwicke's Ill. Ind. Zool. Plates 46, 47, 48. as synonymous with Gould's *Tragopan Hastingsii.* This is again erroneous, for the plates quoted, unless intended as caricatures, can never represent *T. Hastingsii* in any state of plumage. Plate 46. gives what is termed "the adult male" and although agreeing pretty well in other respects with *T. Hastingsii*, it is represented with "*ochreous yellow*

wattles" whereas in living specimens of the latter species, the wattles are of a *bright metallic ultramarine blue ;* those on the head are usually concealed beneath the feathers, and are only occasionally exserted when the bird is excited, but never erected as represented in plate 46. Again Plate 47 represents no phase of plumage of *T. Hastingsii,* while Plate 48, purporting to be a female, is in all probability the young male of some other species,—but is assuredly not the female of *T. Hastingsii,* which is correctly figured by Gould in his Century of Himalayan Birds ; a comparison of his plate with that of Mr. Gray's Ill. Ind. Zool. will, I think, be sufficient to convince any one of the total distinctness of the birds represented. I therefore reject Gray's Synonymes *in toto,* and retain *T. Hastingsii* as an undoubtedly good species, peculiar to the snowy regions of the *North Western Himalaya ;* while *Satyra melanocephala,* if it be a species at all, must be sought for farther to the *Eastward* of the range.* At Simla called "*Jahjee ;*" at Mussooree "*Jwire ;*" by Europeans the "*Argus Pheasant.*"

* We doubt altogether the existence of more than two Himalayan species of this genus, *Hastingsii* in the N. W., and *cornutus* in the S. W. A third exists in the Chinese *Temminckii ;* and fine specimens of all are in the Society's Museum.—E. B.

PROCEEDINGS

OF THE

ASIATIC SOCIETY OF BENGAL,

For December, 1848.

The usual monthly meeting was held at the Society's House on Wednesday evening, 6th December.

The Hon'ble the President in the chair.

The minutes of proceedings of the November meeting were read, and the accounts and vouchers for November submitted.

The following gentlemen, duly proposed and seconded at the November meeting, were ballotted for and unanimously elected :—

T. A. Anstruther, Esq. Madras, C. S.

Rev. J. Richards, Chaplain, Madras Establishment.

Wm. Macintosh, Esq. was proposed by Mr. Alex. Mitchell, seconded by Rev. J. Long, as a candidate for election at the January meeting.

Letters were read—

From Dr. Jameson, withdrawing his name from the list of members in consequence of an application made to Mr. Jameson, by the Librarian, for a book supposed to have been in his possession.

From F. J. Halliday, Esq. Officiating Secretary to Govt. of India, Home Department, dated 25th November, transmitting a list received from Capt. Kittoe, of the pieces of sculpture presented by Government, as recorded in the Proceedings of last meeting.

List.

1. Large erect figure of Sakhya, with kneeling attendant.
2. Large erect figure with six arms, holding the attributes of Brahma.
3. Large seated figure of Buddha on lion and elephant throne, with a figure of a female dancing on a prostrate Gunesha; height 5 ft.
4. Large seated figure of Buddha ; 4 ft.
5. Six-armed figure seated ; same attributes as No. 2 ; height 3 ft.
6. Erect figure of Buddha and attendants ; 3 ft.

7. Female figure of Pudmavati, or Mahamaya on lion throne, inscription; 3 ft.

8. A very elegant erect figure, 2′ 6″.

9. A small Buddha seated; 2 ft.

10. An erect (female) figure, two attendants, with inscription—"Sri Balchundra," 1′ 10″.

11. A Budhiswata or prince, 1′ 8″.

12. Small four-armed male figure, 8″.

13. A small figure of Budhiswut with inscription; 2.′

14. A remarkable fragment of a figure of a fat man seated on lotus-stool; 3.

15. Figure representing the Nirvan or death of Śakhya, beneath the two trees, with his disciples lamenting, and heavenly musicians playing.

16. Fragment of a beautiful miniature Chaitya (not sent).

17. Ditto of a Chaitya figure of Budhiswatus and inscriptions (not sent).

18. Shiva and Parbutti; the Siva has six arms; from the Chaitya at Poonaha.

19. Siva and Parbutti and ten Avatars, from the Chaitya ditto.

20. A Guryogh in two pieces; in shape of a monster with a trunk.

21. A seated figure of Buddha in two pieces with attendant figures; 3′.

22. A large erect figure of Sakhya with royal umbrella, attendants; 4′ 6″.

23. A broken figure with six arms; in two pieces.

24. Seated Buddha on lion throne; 3′ 6″.

25. Large figure (erect) of Mahamaya; 6 ft.

26. A small pillar.

27. Seven small Chaityas.

(Sd.) M. KITTOE, Capt.
Archæological Enquirer.

(True Copy)
FRED. JAS. HALLIDAY,
Off'g. Secy to the Govt. of India.

From H. A. Harland, Esq. M. D. Genl. Secretary Honkong Branch of Royal Asiatic Society, forwarding a copy of the Transactions of the Society for the past year.

From the Secretary Royal Asiatic Society, London, dated 1st Sept., calling for payment of subscription to the Oriental Translation Fund for 1847-48, (£21.) Payment directed accordingly.

From Henry Vincent Bayley, Esq. dated London, August 19th, requesting co-operation in the preparation of a revised edition of his Bengal and Agra Gazetteer. The Librarian was directed to afford the information required.

From Dr. Campbell, Darjeeling, communicated by the Hon'ble the President, giving a summary report of Dr. Hooker's progress in the eastern Himalaya.

From Dr. Campbell, forwarding, with a chart, a note on some of the results of Colonel Waugh's operations in the Great Trigonometrical Survey of the Himalaya near Darjeeling.

From B. H. Hodgson, Esq. Darjeeling, forwarding a paper entitled 'Anatomy of Ailurus, Porcula, and Stylocerus, with sundry emendatory notes.'

From the same, on the Aborigines of India.

From Capt. Newbold, Madras Army, forwarding notes on the rocks of the Mokattam Chain and of the eastern desert of Egypt, by Hekekyan Bey, Honorary Member Asiatic Society.

The Secretary then read the following extracts from a Report from Oriental Section:—

To Dr. W. B. O'SHAUGHNESSY, *Secretary to the Asiatic Society of Bengal.*

Dated Asiatic Society, the 2nd Dec. 1848.

SIR,—By direction of the Oriental Section I have the honour to acknowledge the receipt of your letter, dated the 6th ult., requesting the opinion of the Section on several subjects of reference.

1. With regard to Mr. Kœnig's books, I submitted a report to the Section, on the strength of which I recommended the immediate purchase and despatch of the books asked for by Mr. Kœnig, the money to be gradually repaid by the sale of Mr. Kœnig's publications. The Section, however, are against the purchases alluded to, without receiving further explanation as to the source whence the expenditure on behalf of Mr. Kœnig is to be defrayed, or some certainty that the Society will not be a loser by the measure. Nor do they think that the Society are at all called on to act in the matter. At any rate they wish the case to be submitted to a general meeting of the Society.

Among Mr. Kœnig's books, there are some of great value, which ought to be in the library of every Oriental scholar, for instance: "Westergaard's Radices Sancrit," "Koregarten's Pancha Tantra," "Bœthlink's Panini," "Lassen's Indian Antiquities," etc., and I have no doubt that the books will sell soon, if their prices be reduced. I submit for the approval of the Section and the Council a list at reduced prices.

2. The Section have not expressed their opinion about the arrangement of the sculptures, referred to in Mr. Bushby's letter.

3. The Section approve of the reduction in the prices of the Society's books, and submit a list recommending a still greater reduction of the prices.

4. The Section approve of the proposition to publish the Kámanduk Níti Sha'stra, in the Oriental Journal.

5. The Section would recommend the Society to subscribe to at least 20 copies of Mr. Corcoran's work.

6. The Section consider Mr. Laidlay's translation of Fa Hian, with its numerous original notes, a valuable addition to Oriental Literature, and recommend to subscribe to at least 30 copies.

7. I take this opportunity to invite the attention of the Society to a work of the highest importance for Oriental literature, viz. Lassen's "Indische Alterthumskunde" (Indian Antiquities). It is of a very comprehensive character, embracing the political, religious and social history of India. In fact it contains the result of the previous researches in India, and is founded on the most diligent study of the various branches of Hindu literature, monuments, inscriptions, etc. as well as on the information of the adjacent nations and of travellers in India. The work is dedicated to the Asiatic Society in very flattering terms. I add a translation of the dedication for the information of the Society.

8. The books and original enclosures are herewith returned.

I have the honour to be, Sir,

Your most obedient servant,

E. Roer,

Secy. Oriental Section of Asiatic Society.

To *the Secretary Asiatic Society.*

Sir,—I beg leave to bring to the notice of the Asiatic Society a rare and interesting manuscript lately received from Capt. Kittoe, and respectfully suggest, if it shall meet with the approbation of the Oriental Section, to publish it in the 'Bibliotheca Indica.'

The work is entitled the "*Polity of Kámandaki*" (कामन्दकीय नीतिशास्त्र) and was composed about the end of the fourth century before Christ, by a disciple of the celebrated minister—Vishnugupta. It treats of the duties of man as a member of society; of the principles and form of civil government as prevalent amongst the Hindus; of the rights and privileges of kings and ministers: of the art of fortification; of the principles of military tactics;—in short, of all the branches of political science, which engaged the attention of Hindu statesmen at the time of Chandragupta. It is perhaps the only work of its kind that is known to exist, and considered with reference to the state of civilization in India about the time of Alexander's expedition, possesses a strong claim upon the attention of the Society.

It comprises twenty chapters, which together with an English version, and notes, would occupy about 120 pages of the Oriental Journal.

I am, Sir

Your obedient Servant,

RAJENDRALAL MITTRA.

Asiatic Society, 1st Nov. 1848.

To the Secretary to the Asiatic Society of Bengal.

SIR,—Being of opinion that the sale of the Society's Oriental Publications would be greatly promoted if the enclosed reduced scale of prices were adopted, I beg to submit it to you for your approbation and recommendation to the Society.

I am, Sir,

Your obedient servant,

RAJENDRALAL MITTRA.

Asiatic Society, 25th Oct. 1848.

Names of Books.	*Present price.*	*Proposed reduction.*	*Proposed price.*
Mahabharata, an Epic Poem, 4 vols.4to.	Rs. 40	8	32
Index to ditto, 4 vols. 4to.	6	2	4
Naishada Churita, or adventures of Nala Raja, 1 vol. 8vo.	6	2	4
Susruta, 2 vols. 8vo.; vol. I. pp. 368; vol. II. 562 pp.	8	2	6
Harivansa, 1 vol. 4to. 563 pages.	5	1	4
Rajatarangini, 1 vol. 4to. pp. 440.	5	1	4
Fatawe Alamgiri, 6 vols. 4to.	48	none	48
Ináyá, 3 vols. 4to.	21	none	21
Khazunat ul Ilm, a Treatise on Mathematics, 1 vol. 4to. pp. 694,	8	4	4
Jawame ul Ilm ul Riázi, 1 vol. 4to. with 11 plates, pp. 168,	4	1-8	2-8
Anisul Mosharrahín, 1 vol 4to. pp. 541	5	2	3
Sharaya ul Islam, 1 vol. 4to. pp. 641.	8	3	5
Istallahat e Sufia, 1 vol. 8vo. pp. 168.	5	3	2
Tarikh e Nadiri, 1 vol. 4to. pp. 386.	8	4	4
Tibetan Grammar, 1 vol 4to. 256 pages,	8	2	6
Tibetan Dictionary, 1 vol. 4to. 373 pages,	10	8	2

Much discussion having ensued on the presentation of this report, regarding the purchase of the books required for Mr. Kœnig—

It was proposed by W. Seton Karr, Esq. seconded by Capt. Latter, and agreed unanimously,

"That in the case now before the Society, Mr. Kœnig has a right to expect that the books furnished to him in March, 1847, be forwarded, and that the Society do procure and despatch them accordingly as soon as possible, but also that for the future the Society do abstain from disbursing or pledging itself to disburse sums in the purchase of works *not* published by the Society, for individuals in Europe, which sums are only to be prospectively repaid by the sale of works received from such individuals, the Society not considering themselves in the light of purchasing agent for any parties."

The other recommendations of the Section were unanimously agreed to, as well as a subscription for 100 copies of Mr. Laidlay's version of the travels of Fa Hian.

The Hon'ble the President then brought to the notice of the Society the loss they had sustained in the death of their distinguished Honorary Member, Mr. David Hiram Williams, and proposed the following resolution, which was unanimously agreed to:—

"Resolved, that the Society desires to record its sense of the loss which this Society, as well as the public service, has sustained by the premature death of David Hiram Williams, Esq., the Superintendent of the Geological Survey, and an Honorary member of the Asiatic Society of Bengal."

"Resolved, that the above resolution be communicated by the Secretary to Mr. Williams' family."

The Curators and Librarian having submitted their usual reports, the meeting adjourned to January, 1849.

(Signed) W. B. O'Shaughnessy,
Secretary.

Report of the Curator Musuem Economic Geology for the month of November.

Geology and Mineralogy.—I can do but little more this month than record what has been received, having but just restored this department of the Musuem to some order.

From Captain H. L. Thuillier—Deputy Surveyor General. Eight Coloured Lithographic Impressions of Captain Sherwill's Geological Map of Zillah Monghyr and Bhagulpore.

W. Bracken, Esq. C. S.—A specimen of Fibrous Gypsum from America.

I have put into the form of a paper for the Journal my notice of the magnificent mass of Meteoric Iron now exhibited, which is the gift of our indefa-

tigable associate and contributor Capt. Sherwill, B. N. I. and refer our readers to that paper for full details of the examination of it.

Economic Geology.—From the late D. H. Williams, Esq. Company's Geologist, we have received specimens of two new beds of Coal, the exact locality of which is not given, but the one is stated to be from a new locality 15 or 20 miles to the south-east of Hazareebagh, and the other from two new beds in the Damooda Coal field; and specimens of Iron ore, also from the Hazareebagh and Burdwan districts.

From Messrs. Jardine, Skinner and Co. a specimen of Coal from Newcastle, N. S. Wales, from which part of the world we hitherto had no specimens for comparison if required.

From J. Homfray, Esq. some small but highly curious specimens of the Ball Coal from the Seetarampore Colliery in Burdwan, of all sizes, from that of a walnut to a small Cheshire cheese. Mr. Homfray has also presented the Museum with another splendid specimen, which appears to be the carbonised and flattened stem of a tree, the first tree stem, I think, of any kind, which has been found in the Coal in this country.

Mr. Homfray's letter is as follows:—

My dear Mr. Piddington,—I have now the pleasure to send you some specimens of the "Boulders of Coal" from a new Colliery opened upon the same vein of Coal as that to which my printed notice refers. The largest boulder I think very unique, and some of the small ones still more so, but you will observe that in some pieces I have sent there are 2 small boulders or nodules close to each other, and imbedded in the circumjacent Coal remarkably—the boulders having their concentric layers of Coal, whilst the masses in which they are imbeded has the layers *horizontally* disposed.

There is one specimen which has the appearance of the stem of a tree, as though it had been cut across. The layers of Coal are also concentric, just similar to those in the stems of trees—this specimen was originally about 3 feet in height, but broke across in its carriage from the Colliery to this place. I am still very undecided what to say about the formation of the balls, the manner in which they originally increased by additional coats of carbonaceous matter, or, if you please, Coal. About 175 feet above the Coal vein are found the Ironstone measures 43 feet in thickness, and having several veins of Ironstone, some of which are what we call *ball Ironstone.* In my survey of the Palamow Coal July 1837) recorded in the Coal Committee's Report, (page 159, and section, p. 162,) the Ironstone thence alluded to contains beautiful "Ball Ironstone," and in page 163 you will see the allusion to the existence of pebbles and rounded conglomerates in the sandstone overlying one of the veins of Coal. I mention these to call your attention to the fact of its having been

now eleven years under notice. I had occasion to send home some copies of my printed Coal Survey reports to Glamorganshire, and it has been the means of arousing attention to the same circumstances as to Boulders of Coal being found in veins of Coal which have *horizontal layers.* An old acquaintance, Mr. Benson of Swansea, an extensive Coal Miner and Copper Smelter, at the late meeting of the British Association, read a paper on the Boulder Coal found in a vein of Coal. I send you the paper, which is interesting enough, but I must not be deprived of my priority of its public notification, which now stands as recorded in the Society's Journal, as well as in my printed reports of 1842.

I beg you to take care of the paper, not having any other Copy, and request you to return it as soon as you conveniently can.

1*st Nov.* 1848.

Your's truly,

J. HOMFRAY.

P. S. It may be interesting to some persons to know that the locality of this new Colliery whence these Boulders are taken, is situated *less* than one mile from the site of the *oldest* Colliery in that district opened by Mr. Heatly near Aytura village, and upon the same vein.

" *The following is an extract from Mr. Benson's paper.*"

" Mr. Benson next read a communication on a boulder of Cannel Coal found in a vein of common bituminous Coal.

About ten years since, Mr. Logan noticed the frequent coal and iron stone conglomerates occurring in the sandstones of the Town Hill, near Swansea. His attention was first awakened to the subject from the discovery of an undoubted boulder of Cannel Coal above the seam of common bituminous coal, called the Five-feet Rock Vein, at Penclawdd. The series of coal measures included in the Pennant rock are easily traceable throughout the South Wales Coal field, from the greater hardness of their sandstone, and their elevation as a nearly continuous range of hills. It would appear that whilst the sandstones and slabs of the coal measures below the Pennant rocks have been deposited or formed in comparatively quiet water the sandstones of the Pennant series contain frequent conglomerates of coal and ironstones, drifted plants, and occasionally small boulders of granite, with other proofs of drift to a considerable extent having occurred during the period of their formation. Bivalve shells are also found in considerable masses in the shales below the Pennant group, both on the north and south outcrop, evidently showing that they now repose unmoved from their original beds, whilst the only shells I have yet seen on the Pennant were at a short

distance ftom the Penclawdd seam, which is one of the lowest in that series. During the present year another boulder of cannel coal, was discovered in the Penclawdd seam, which the workman who found it positively affirms to have been in the vein of bituminous coal. The boulder is 13 inches long, 7 wide, and 3 thick, one corner having been broken off after it had become rounded by attrition, probably a short time prior to its arrival at the spot in which it was found; a siliceous cement has coated a part of the surface of this fracture, has filled the cavity caused by another fracture and also attaches a piece of rock to the boulder. The Penclawdd five feet vein, is about 300 yards in geological position below the quarries of the Town Hill sandstone, and throughout this depth there would appear to be frequent instances of drift and false beds of coal: in some specimens the pebbles of the older or drift coal having from their greater hardness, penetrated into and distorted the drift plants, which have since become coated with the newer coal. One or two other pieces of cannel coal have been found at Penclawdd, but as these were discovered in the heap of bituminous coal, after it had been raised to the surface, and from exposure to the air had heated, and slacked, they may have originally formed parts of large boulders, and their present angular form is no certain proof of their having been derived from other beds in the immediate locality. In the subjacent measures of the South Wales coal field, some seams associated with regular seams of cannel coal are known to exist about 700 yards below the Penclawdd vein, and laying conformably with it. In alluding to the boulder he discovered Mr. Logan remarks:

"To suppose that the boulder is derived from the lower seams, after they had been indurated, converted, and crystallized, would, it is apprehended, be carrying the age of the whole deposit to the extent that has never yet been conceived and is perhaps inadmissible for it is not easy to account for any mode in which a fragment of them, without a disturbance of the stratification, which yet exhibits none of a requisite order, could be displaced and conveyed to the newer beds whilst forming. It is therefore, safer to refer the boulder to some anterior deposit of coal, perhaps no longer in existence.* To attempt to determine whether these boulders of cannel coal are derived from the lower measures, or from some anterior deposit, I have not been able to collect sufficient data, but some pieces of the top stone of the Penclawdd vein may be interesting, as they show that a conglomerate of small pebbles of ironstone, apparently identical in quality with the large deposits of ironstone of the lower measures, has been deposited within a few inches of the top of the Penclawdd vein of coal. If the boulders have been derived from the lower veins of the

* See Journal for January, p. 60, in which, with reference to our Indian Ball Coal, the same view is expressed.—*H. P.*

series, they may probably have been supplied from partial destruction of the lower measures at the south-west corner of the basin, previous to the formation of the veins included in the Pennant series of sandstones. It may have occurred, that during the gradual subsidence of the land beneath the estuary or basin in which the successive strata of coal, sand, and shale have been deposited, communication between such basin and the larger seas have been formed or enlarged, and that the detritus of the lower measures, thus exposed to the action of the sea, has from time to time supplied the boulders and drift during the formation of the Pennant series. The greater coarseness of the Pennant sandstones, and the frequent conglomerates and marks of drift, infer that these deposits have occurred frequently under the action of the rough sea, rather than of the quiet lake, and if the boulders of granite should, upon examination, be found to be equivalent to that of Pembrokeshire, it would rather point to the line of drift. The destruction of a portion of the lower beds before the deposit of the higher, might, as I have ventured to suggest, have been effected without disturbing the conformity of the lower and Pennant measures on the existing portions of the coal field. The question whether a large portion of the coal measures has or has not been cut off by the anticlinal line of Cefu Bryn, would not affect the suggestion; as this upheaving of the old red sandstone equally distorts the higher and lower measures, and probably occurred when the present coal field was again raised above the level of the waters. But if the suggestion is admitted as deserving of further enquiry, namely, that these boulders are derived from the lower veins of the same coal field, the inference (and a question of considerable interest it is) would follow, that sufficient time has elapsed between the deposit of each vein to allow the perfect crystallization and formation of the vein below it. It also yields information interesting with reference to the ascertaining of the manner of the formation of the coal; as it would infer, that the material of which, in this instance, the bituminons vein was formed, was originally too soft and yielding, notwithstanding its present hardness and density, to fracture the boulder during the period of pressure necessary for its formation, and also that the chemical agents acting, or escaping during the formation of the bituminous coal, do not appear to have in any way affected the cannel coal deposited within it."

It will be noted that Mr. Benson speaks of boulders of *Cannel* Coal, which renders these facts still more extraordinary. I have not been able to examine our boulders, yet having some other researches on hand which are not yet completed.

H. PIDDINGTON.